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INTRODUCTORY ANIMAL HUSBANDRY



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INTRODUCTORY ANIMAL HUSBANDRY

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PREFACE

The purpose of this book is to acquaint the student with the fundamental problems and essential general concepts of livestock production in the United States. The content is somewhat comprehensive in scope, yet it is arranged and presented to meet the needs of beginning students at the collegiate level. It has been the intention to make available to the reader much factual information from various sources relative to general animal husbandry. An attempt was made to draw together many of the basic facts on livestock production known by producers and scientists. The book is designed primarily for use as a text for college students, yet the subject matter is presented in a manner to be useful in the teaching of vocational agriculture, particularly as a reference text.

Although it has been the intention to have this presentation up to date, it should be pointed out that the subject matter is not static. In the livestock field, as in others, readjustment must constantly be made to meet changing conditions. Our agriculture, and consequently animal husbandry, has been changed by group action and other forces. The added use of science, greater specialization, the readjustment to foreign relationships, and our changing diet have very directly affected livestock raising.

Perhaps more evident is the effect of farm mechanization upon agriculture in general and livestock in particular. Equally striking have been the changes in our marketing of livestock and the merchandising of meat, milk, wool, and other animal products. Currently available data such as the outlook reports, market reports, and reviews may be used to provide an interest approach to many of the sections.

The material included is that which has been quite definitely proved, since this is mainly a survey of animal husbandry and marketing livestock and livestock products. Some controversial issues are discussed, and it was the intention to present the

available facts on such subjects. Theories which still are unproved are generally omitted.

Each part is devoted to one kind of livestock, and includes chapters or parts of chapters dealing with types, markets, market classifications, prices, feeding, management, and breeding. Rather specialized chapters in each part cover the processing and distribution of the animal products or other special considerations, such as wool of sheep, milk secretion of dairy cows, etc.

The order of presentation is based upon several years of teaching experience in this field. Yet the various parts are so written and cross-referenced that the order can be changed to suit the convenience of the instructor. It seemed logical to start each kind of livestock with its place in farming and ranching and then follow with market requirements, marketing methods, processing, and merchandising, closing with feeding, management, and breeding. The subject of breeds is not within the scope of this text, and the material on feeding and breeding is quite general. References on these and other subjects are suggested at appropriate places, and a list of reference books is included in the Appendix.

The published material on animal husbandry was drawn upon freely in compiling and writing the text. Much material was drawn from various sources at the Iowa State College. Stenographic help was generously provided by this institution. The United States Department of Agriculture and various agricultural colleges and experiment stations supplied subject matter and illustrative material requested. For all of this and the many pictures loaned for use as cuts the writer is deeply indebted. Credit is given for the material as it appears.

Through long association with Deans H. H. Kildee and M. D. Helser and Professors P. S. Shearer, W. F. LaGrange, Elmer Hansen, A. B. Caine, J. C. Holbert, Jay L. Lush, D. L. Espe and Fred Beard, the writer has acquired much of what has been included in this book. Muriel Hall Anderson, E. L. Vieth, and other coworkers read the manuscript and offered many helpful suggestions. Ernest Behn prepared the line drawings. Assisting in the preparation of the manuscript and securing of data were Glenn Spry, R. Alan Williams, Robert Smith, W. Lee

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INTRODUCTORY ANIMAL HUSBANDRY

Chapter 1

LIVESTOCK IN AGRICULTURE

The raising of animals is as old as civilization itself, for our common farm animals were domesticated before the beginning of written history. Paleolithic man hunted animals for food and raiment; his successor, the Neolithic man, tamed and confined them. It was in this Neolithic or New Stone age that men first practiced agriculture, which included the raising of domestic animals.

Domestication of Animals

Animal domestication no doubt began as a means of safeguarding the food supply for times when hunting was poor. It is believed that the first animal to be domesticated was the dog, which served as companion and for other uses. Animals were early used as beasts of burden, both for draft and pack. In fact, the horse was among the first subjugated to man's desires.

The domestication of animals was one of the essentials in the development of civilization, according to Shoosmith.¹ "The domestication of animals led to the increase of population and the strengthening of tribal habits and directly gave rise to that division of a labour apart from which civilized life is impossible." The opinion is often expressed that it is doubtful if man would ever have risen above barbarism if it had not been for the servitude of animals.

Certain characteristics distinguish domesticated animals from wild animals, and even those of the latter group have been somewhat tamed. Those animals which have been domesticated are naturally tamer than the others. Further, they thrive under artificial conditions and reproduce regularly in confinement. Some animals are not subject to domestication. The

¹ F. H. Shoosmith, *Life in the Animal World*, p. 253. R. M. McBride & Co., New York, 1937.

zebra and the American bison are somewhat in that class. Even though very young individuals of either of these be captured and trained, they fail to reach a state of domesticity and their response is often unpredictable.

Domestic animals were spread in various directions from the place or places of origin to sections that afford a favorable environment. In the spread throughout the world animals were modified in physical characteristics to conform with the environmental conditions. Man was responsible for distribution of the domestic forms; in fact, colonists included such animals as were available in their native land among their possessions in migrations. Colonists, travelers, armies, and missionaries extended the frontiers of livestock raising to the new lands. Colonization brought domestic animals to this continent. We have not contributed any new species to the group, and very few breeds are of American origin.

Animal Husbandry

Animal husbandry deals with the production of domestic animals, or livestock, and it embraces all of the phases of breeding, feeding, and management. Through the fund of knowledge gathered by experiment and experience, the usefulness of domestic animals to mankind has been greatly expanded. The livestock raiser has a profound interest in the marketing, processing, and distribution of animal products because his success is in a large degree dependent upon consumers' acceptance of the animal products. The consumer is often quite far removed from the producer. The pork chop, for example, may move great distances and pass through several hands from the producer to the processor and finally to the consumer. A consumer wants a high-quality product at a cost comparable with that of other goods. Both quality and cost can be markedly affected in the progress from producer to consumer. The efficient and economical marketing, processing, handling, distribution, and merchandising of animal products is therefore a matter of concern to producers and consumers alike.

It has been stated that much which is animal husbandry is still in the realm of opinion. Our knowledge has come in part from experience, and that so derived may be in part opinionated,

but much which was formerly accepted as fact has been either proved or disproved by careful investigation. Cattle raising on the range, for example, was at one time based entirely upon the experience of the past handed on by word of mouth. Today the many practices in the enterprise have been tested experimentally, and the modern western cattleman has the benefit of scientific research in addition to the real colorful experience of his predecessor. The scientific method has revealed, among other things, methods of production, and of disease and parasite control, which have enabled the livestock raiser to produce more and better animal products at lower cost.

Food and clothing are primary needs of mankind, and since agriculture supplies these needs it is fundamental or basic. Some 32 million people who reside on our farms make available our domestic supply of food and clothing materials and the many other essentials of farm origin. The ratio of farm population to total population is about one to four. This serves to bring out the dependence of the urban population upon farmers. Farmers in turn are dependent upon industry for many goods and services.

Functions of the Livestock Enterprise

The functions of livestock as a part of good farming or ranching may be stated as follows:

1. To supply a market for pasturage and other unmarketable roughage.
2. To furnish a home market for marketable grain and roughage.
3. To provide manure for the maintenance of the fertility of the soil and also to control soil erosion.
4. To provide a profitable use for labor and managerial ability.

In short, livestock provides a means for the disposition of farm-raised or ranch-raised feeds, including pasture, and permits the marketing of a concentrated product which removes but little of the soil's fertility. This in turn gives a use for farm labor and management ability which can be dovetailed well with crop production. Further distribution and diversity of income is accomplished. Also, there is usually an improvement in

the diet on the farm when home-raised animal products are available.

Soil Conservation and Livestock Production

As we are confronted with the national problem of conserving our soil to prevent an agricultural decline, the use of livestock in the maintenance of soil fertility takes on great significance. We have no more virgin land to exploit or develop. Therefore, we must conserve for ourselves and our posterity the productive capacity of our soils.

In the program for soil conservation the tendency has been toward more hay and pasture crops rather than those which involve more intensive tilling of the land. With more land for grazing, our livestock population must be shifted to utilize more pasture crops.

A permanent agriculture should be based upon land utilization rather than the shaping of the crop program to comply with a proposed livestock program. If that which is grown is adaptable to the soil and climate, and due consideration is given to soil improvement, then livestock of the kind that will make economical use of the feed will give a balanced farm program. Livestock farming is effective in crop utilization, and if manure is conserved much of the native soil fertility can be retained. Integration of crop and livestock enterprises making use of modern methods of soil retention and adding minerals which may be depleted will give permanency to the land's productivity. Only by such means can the productive capacity of our farms be maintained.

The Management of Livestock

The maintenance and management of a livestock enterprise should be directed toward the fulfillment of certain objectives or preconceived plans. If livestock are to contribute to profitable farming, a well-thought-out plan of production and system of management are essential. It is obvious that the place occupied by livestock raising is quite largely dependent upon the agricultural characteristics of the region. When a ranch or farm produces a usable supply of feed (pasture, roughage, or grain) the operator may well consider the marketing of it

through livestock. On land that is uncertain in grain crop production a shift to feed crops or grass may be advisable for uniformity of income.

In many systems of farming, livestock constitutes a major enterprise. On general farms where sufficient livestock is kept to utilize the pasture and to consume a good part of the hay and the feed grain grown, farm incomes are usually higher than on farms which sell grain.

The relative position of livestock and other produce of farms is variable, some farms having no livestock while on others it may be the major product. On the whole, the importance of livestock is evident since it is the source of more than one-half of our agriculture income. Livestock and livestock products are one of our largest industries in volume of business. However, crop production is not to be minimized, as livestock convert crops into salable materials or cash income. Such farm products as feed grains, hay, fodder, silage have farm value but are marketed mainly through livestock. The efficient manager attempts to maintain a proper balance between the capital, land, and labor involved.

Kind of Livestock to Keep

There are many factors to consider in choosing a livestock enterprise for a ranch or farm. For the general farm, livestock combinations give the greatest possibility of uniform financial returns. Some of the more important features which may determine the most useful kind of livestock to produce are: (1) the size of the farm, the productive capacity of the land, and consequently the amount of home-grown feed which can be raised and also the amount of usable pasture land; (2) the amount and kind of building equipment; (3) the financial resources available; (4) the ability, skill, and likes of the operator; (5) the amount of labor available for use on livestock; (6) the location of the farm with respect to markets (expenses of marketing vary with the distance of shipment. Producers near centers of consumption may have low marketing costs, but other costs are usually higher); (7) the costs of all the items that enter into production. Without a margin of profit there is no incentive for production.

Legislation and Agricultural Production

Farm legislation has been a factor in the shifts in agricultural production. The economic control it imposes has been mainly on the crops grown, but this in turn affects livestock production. The production, marketing, and storage of crops have been affected by laws which have for their general objectives the improvement of the economic and social condition of the farmer. To accomplish this end, many adjustments in the use of our agricultural land have been imperative. Our federal legislation has involved, among others, the principles of price-maintenance, ever-normal granary storage, soil conservation, crop insurance, production allotment, farm security, surplus commodities purchase, and commodity credit.

Federal legislation that has been helpful to farmers has also been of value to city dwellers. Through the national marketing of surpluses, food is available to distressed urban populations, consequently improving the national diet.

Land Use in the United States

The land area of the United States is approximately 1,905,361,-920 acres. Of this total area, about 56 per cent is classified as land in farms. This is actually all land in farms and includes areas of land not under cultivation and land not being used for pasture or grazing. It includes the land under control of farm operators. It does not include nonagricultural land or land grazed or pastured neither owned nor leased by the operator. Much of the land not in farms is used for grazing. This land is classified according to major use as grazing land, public and private, and forest land grazed, public and private. About 20 per cent of our total land area is such grazing land which yields pasturage for cattle, sheep, and other livestock.

Land use is not constant. There is continual shifting of crop production based on the demand for agricultural products and the productive capacity of the land. About one-half of the land in farms is crop land, and some of this is idle. Nearly two-fifths of our farm land is in pasture, while the balance is woodlot, wasteland, roads, and farmsteads.

The farm crop land produces a large amount of feed crops fed to domestic animals on the farms. With crops like corn, for

example, the farm value of the crop may be six times the cash income from it. A crop like tobacco presents the other extreme, since the farm value and cash income are about the same. It is mainly a cash crop. The corn crop is chiefly a feed crop and is marketed largely as livestock products.

Considering the grazing land, the farm pastures, and the feed crops grown, the production of nearly 70 per cent of our land has its production marketed as livestock products.

Classification of Farms on Major Income

The farms of our country are classified on the basis of major income in census reports. The five leading classes of farms in income and the percentage in each group are as follows in the sixteenth census report:

FARMS CLASSIFIED AS TO SOURCE OF MAJOR INCOME

<i>Major Income</i>	<i>Percentage of all Classified Farms</i>
Field Crops	36.3
Subsistence	32.5
Livestock	12.2
Dairy	10.4
Poultry	3.6

Subsistence farms are those upon which the farm products used by the farm household are the major source of the farm income. On more than one-third of our farms livestock, dairy, or poultry are regarded as the main source of revenue.

The distribution of the value of agricultural products of our farms is somewhat different than that above since the subsistence farm group is broken up into different sources of income. The following breakup of farm income, taken from the census report, considers the value of all farm products sold, traded, or used by farm households.

PERCENTAGE OF INCOME FROM VARIOUS FARM PRODUCTS

<i>Source of Income</i>	<i>Percentage of Distribution of Value of Product</i>
Field Crops	31.6
Livestock and Livestock Products	24.0
Dairy Products	14.3
Poultry and Poultry Products	7.1
Fruits and Nuts	3.8
Vegetables Harvested for Sale	2.6

The farm income from livestock, milk, and poultry is about 45.4 per cent of the total income. This proportion is changeable, depending upon the relative value of the various farm products and the amount produced. In addition to the income aspect, the available home supply of livestock and poultry products greatly improves the diets of farm people.

Agricultural Regions

Within our country we recognize several rather distinctive areas on the basis of the kind of agriculture predominating therein. These distinctive types of agriculture result from the many different physical conditions which determine what crops can be successfully grown. Such conditions as soil moisture, topography, and temperature affect the vegetation and crops grown, which in turn are related to livestock production. In Figure 1 the extent of the different regions is shown. Agriculturally the eastern part of the United States is quite different from the western portion. This dividing line approximates the 103-degree parallel of longitude except that it veers to the northwest in Montana and to the southeast in Texas. To the east of this division a humid climate generally prevails, while to the west an arid climate is general, except along the west coast and the north border. We therefore have the rough division into east and west, which are the humid and arid areas. Then there are the northern and southern divisions in our country.

The thirteen following crop belts or areas are recognized:

1. Grazing and irrigated crops region.
2. Cotton belt.
3. Corn belt.
4. Hay and dairy region.
5. Corn and winter wheat belt.
6. Spring wheat region.
7. Hard wheat region.
8. Forest and hay region.
9. Humid subtropical crop belt.
10. Columbia plateau wheat region.
11. North Pacific forest, hay, and pasture region.
12. Pacific subtropical crop region.
13. The middle Atlantic truck crop belt.

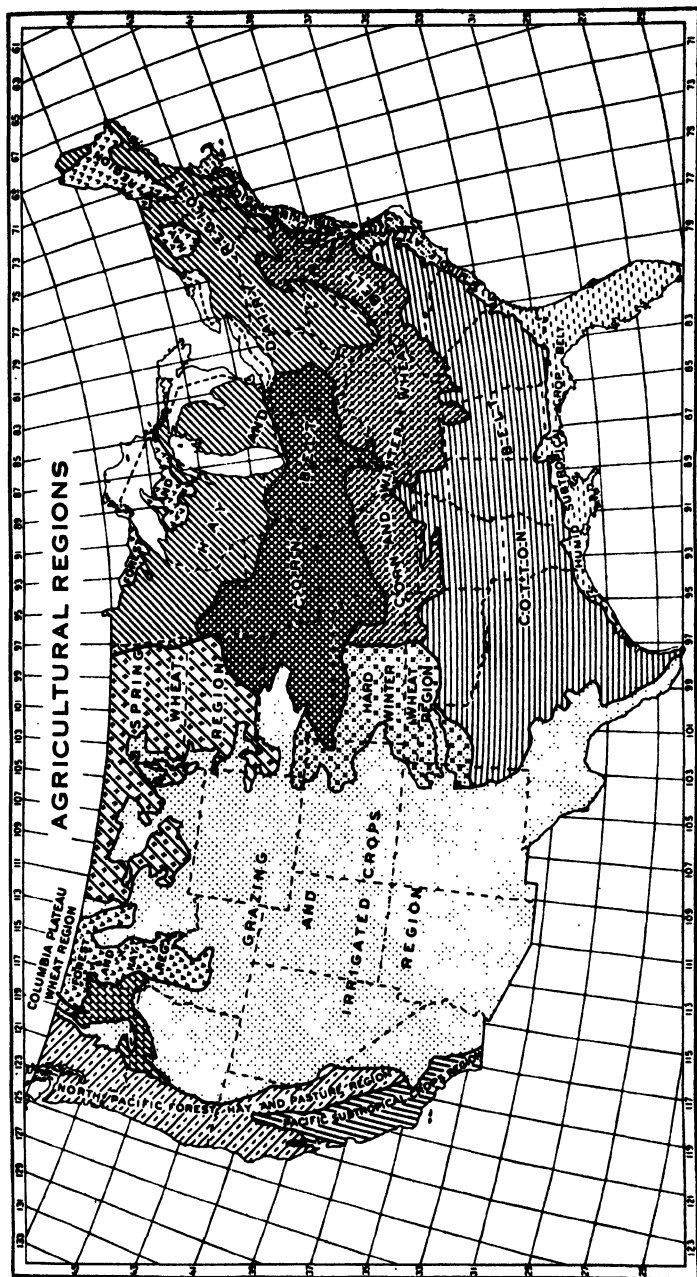


FIG. 1. The agricultural regions. The section west of the 103rd meridian of longitude is generally more arid than the eastern part, except in the northwestern section. The crops and livestock raised are influenced by the soil, topography, temperature, and crops grown.

Geographical Divisions of the United States

The agricultural regions of our country do not coincide with the commonly used geographical divisions. The latter are the convenient divisions of the census reports, but within a division there is a great difference in the major agricultural production of crops. The agricultural census is taken with the census of population in each decennial enumeration. Further, we have of

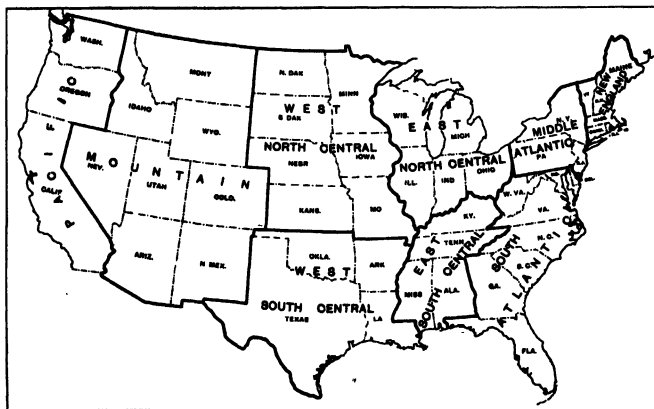


FIG. 2. Map of the United States, showing the geographic divisions.

late taken a mid-decennial enumeration or agricultural census. The census geographical divisions are shown in Figure 2. These sections are New England, middle Atlantic, east north central, west north central, south Atlantic, east south central, west south central, and mountain. Such a subdivision of the country facilitates a discussion of our agriculture and therefore our animal husbandry. It is somewhat confusing, as these geographical divisions may include more than one of the principal crop belts. The corn belt, for example, is mainly in the north central region but not wholly so. The state lines, too, do not coincide with principal crop area lines. The state of Minnesota includes four major crop agricultural regions — spring wheat, corn, hay and dairy, and forest and hay. These regions are distinctive, but the margins are not sharply defined.

Chapter 2

CATTLE

Cattle were used by man before he began to keep permanent records. Prior to their domestication, cattle were hunted and used as a source of food and other materials. Just when man confined cattle so that a more constant supply of cattle products would be available is not definitely known.

Time of Domestication

This change or domestication was probably contemporary with man's transition from savagery to the first primitive civilization, early in the Neolithic age. Herding of cattle was one of the first indications of the superiority of one tribe over another. In South Africa, for example, the keeping of cattle marked the Hottentot as superior to the nomadic Bushman who lived by the hunt. Cattle have served through the ages as objects of worship and mythology, as sacrificial offerings, and for other uses as well as for a source of meat, milk, hides, and as beasts of burden and sources of power. Early drawings, carvings, and writings of the Sumerians of old Mesopotamia, and in ancient Egypt and ancient India, indicate man's use of cattle in those countries as early as 4000 to 5000 B.C. The word "cattle" supposedly is another form of the words "chat-tel" and "capital," meaning goods or property. Cattle among many of the primitive people were the most valuable goods and not infrequently were used as a measure of the value of other property.

From the early centers of culture domestic cattle spread to all parts of the world with the spread of civilization and with colonization.

Zoological Classification

Domesticated cattle are classed in the family *Bovidae*, which includes ruminants with hollow horns and hoofs with an even

number of toes. Fossil remains of this species have been ascribed to the Miocene age. Domestic cattle are descended from wild cattle of the genus *Bos*. Besides cattle this genus includes the following living forms: banteng, bison, gaur, gayal, musk-ox, true buffalo, yak, and zebu.

GROUPS OF GENUS *BOS*

Five groups or subgenera are noted in the genus *Bos*. Following are the various groups and the species which are found in each:

1. **TAURINE.** Included here are common and humped cattle. Further discussion of this group follows in subsequent paragraph.

2. **BIBOVINE.** This group embraces the banteng, gaur, and gayal, which are closely related and cross readily. These are humped forms native to southern India. Compared with the taurine group, they are shorter in the forehead and have less width at the base of the horns, which are massive and heavy. A few of the gaur have been domesticated; the gayal has long been more or less domesticated. The banteng, which is also common on the Malay Archipelago and the islands of Java, Borneo, and Sumatra as well as in India, is widely domesticated.

3. **LEPTOBOVINE.** This group is now extinct. Fossil remains of this subgenera have been found in France, Italy, and India. Cylindrical, curved horns of small size, attached far below the vertex of the skull, typified the group.

4. **BISONTINE.** Embraced in this group are the yak and the bison, which have voices resembling those of swine. The yak is indigenous to the mountainous areas in central Asia, and wild herds still exist in that section. The domesticated form of the yak is regarded as being a cross between the wild yak and some of the taurine group. To this group belongs the American bison, incorrectly called buffalo, which resisted domestication except for the "cattalo," the cross with cattle.

5. **BUBALINE.** This group is that of the true buffalo of Asia and southeastern Europe. They are distinctive in head shape and horns as well as in body. They are widely used for draft, beef, and milk production.

In usefulness to man the taurine group leads; however, the Asiatic buffalo, banteng, gayal, and yak have been successfully domesticated.

Taurine Group

Commonly cattle are grouped under one species, *Bos taurus*, however a separate species name (*Bos indicus*) is given to the Zebu group, those of the division bearing a hump. A wide variety of the Zebu group exists in Asia and Africa. They have been used to improve the cattle of the coastal region of the Gulf of Mexico as well as in other places in the tropical region suited for cattle raising. The hump over the shoulders, large drooping ears, and different call distinguish the Brahma from domestic cattle. No wild forms of the Zebu have been found, and its domestication was as early as 4000 B.C. It is quite probable that the Zebu was derived from Indo-Malay cattle or the banteng.

European Cattle

Our domestic cattle descended mainly from European cattle. Often mentioned in writings on European prehistoric cattle are those of the lake dwellers of Switzerland, which are referred to as "little marsh cows." Many wild species of cattle are mentioned in the early history of European cattle. Perhaps these might be more correctly termed geographical varieties. These are of interest because our present cattle probably descended from these varieties. Four wild forms were the foundation for our common breeds. Morse¹ considered these so closely related that some, perhaps all, might be regarded as varieties of the *Bos primigenius*.

Early Species of European Cattle

The division into species is based largely upon skull characteristics, but differences of opinion exist as to the grouping.

Following is a discussion of the early species of European cattle and also the probable breed descendants from each species.

¹ F. W. Morse, "The Ancestry of Domesticated Cattle," 27th *Annual Report* B.A.I., p. 187. U.S.D.A., 1910.

1. *Bos taurus primigenius*. This is the urus, aurochs, or Giant Ox that existed in the early Neolithic age. They were very large cattle, being six or seven feet high at the withers. The following breeds supposedly descended from this species. Holstein-Friesian, Shorthorn, Aberdeen Angus, Polled Shorthorn, Red Polled, Dutch Belted, Galloway, West Highland, and Normandy. The Ayrshire also probably descended from the *primigenius* crossed with the *longifrons*, although at least one authority would classify this breed as well as the West Highland and Galloway to the *longifrons* species.

2. *Bos taurus longifrons*. This species, often referred to as the "Celtic ox," was much smaller in size than the *primigenius* and also existed in the Neolithic age. Its smaller size is regarded by some authorities as being due to unfavorable environment. Among the breeds existent today, the Brown Swiss and Jersey probably descended from this species. Guernseys probably came from this same foundation stock crossed with *primigenius*.

3. *Bos taurus brachycephalus*. These are the short-headed cattle of our present breeds. Kerry, French Canadian, Brittany, Sussex, Devon, and probably the Hereford came from this foundation. However, some authorities claim that Herefords should be credited to the *primigenius* species and the Kerry and Brittany to the *longifrons*.

4. *Bos taurus frontosus*. This species has been found in fossil remains in Sweden. The breeds of Sweden, the Simmenthal, and other spotted breeds now in Switzerland and South Germany are of this type.

5. Some other species mentioned in early writings include:

a. *Bos taurus akeratos*, which was the hornless breed of northern Europe.

b. *Bos nomadicus*, which was contemporary with man in India during the Paleolithic age.

Domestic cattle are largely from the *primigenius* and the *longifrons*, as will be noted by the breed classification. The wild white cattle, because of their nearness to the prehistoric forms, are of interest to students of domestic genealogy and are discussed in the following paragraph.

*Wild White (or Park) Cattle*¹

This breed is the nearest to the prehistoric forms which is in existence at present. There is disagreement as to the ancestral form of this breed — it is from the *Bos primigenius* or *Bos longifrons* or both. These wild white cattle persisted as late as the seventeenth century in certain parks and forest areas in



FIG. 3. A longhorn steer. At one time these were quite common on the Texas range. Now they are comparatively rare. Compared with present-day cattle they are leggy, rangy, thin fleshed, and slow maturing.

England and southern Scotland. The color is white, but the tips of the horns, the muzzle, the circle around the eyes, and the hoofs are black. The ears are black or brownish-red inside and about the same color on the outside. In form, Park cattle are of the beef type, but the quarters are rather thin and muscular. A Park Cattle Society in England promotes the interests of this breed and maintains its purity.

¹ Alvin H. Saunders, "The Taurine World," *National Geographic Magazine*, Vol. 48, No. 6, 1925, p. 645.

Introduction of Cattle to North America

The first cattle to reach the western hemisphere were brought over by the Norsemen who landed in "Vinland" (Massachusetts) in 1006. Cattle were brought to North America by Christopher Columbus on his second voyage in 1493, and in 1525 cattle of the Spanish type were taken from the West Indies islands to Vera Cruz, Mexico. Portuguese traders brought cattle and hogs to Newfoundland and Nova Scotia in 1553. The first cattle importation credited to the country which is now United States was made in 1535 to Virginia, but they perished or were slaughtered. The first sizeable cattle importation reached Jamestown in 1611. Cattle production increased rapidly in New England, and cattle of individuals were grazed in herds. With the growth of the population and subsequent increase of cattle, the common pasture (or commons) for the villages became inadequate for the herds. Therefore, many new towns were settled. About two centuries later there was another movement of cattle into the United States from Mexico. These were of the Spanish type or "longhorn cattle," which were first brought to Mexico in 1521.

Growth of the Cattle Industry in the United States

In historical sequence, cattle raising followed hunting in the frontier and was in turn succeeded by pioneer farming. The cattleman followed the hunter and trapper in the settlement of our country and was supplanted by the permanent settler who also raised cattle. Cattle raising had crossed the Alleghenies and penetrated Ohio and Kentucky by 1800 and by 1860 was in Illinois and Missouri.

By 1870 cattle were quite generally distributed throughout the entire country. The great plains were established as a cow country soon after 1880. The "longhorn" cattle spread from the south and the descendants of the British breed from the east. The longhorn cattle were frequently driven in large herds over trails many of which became very famous. As early as 1850 and until the late '80's millions of cattle traveled the cattle trails from Texas to cattle ranges in the northern great plains and slaughter centers. In the early days trailing was a necessity because there were no railroads or meat packing plants

in the west. The hide and the tallow were the main products of cattle slaughter when it was difficult to market the carcass or meat.

Later, the cattle industry became centralized in the western range because of the available pasture, and in the north central section because of the abundance of concentrated feeds and pasturage. Cattle numbers have increased since 1870 and have shown cyclical movements. In proportion to the total number of cattle in the United States the numbers of cattle in the north and south Atlantic sections have decreased, while those in the south central have changed but slightly. The north central and the western sections alone have been responsible for our expanded cattle production. Our country was settled by migratory waves which moved from the east to the west. Industrial production predominates toward the eastern seaboard and is for the most part widely separated from our most fertile farm land. Cattle, especially of the beef type, then moved toward and centered around feed-producing areas. It has been estimated that the average pound of meat travels 1000 miles from the place of production to the point of consumption. Dairy cattle, on the other hand, tend to cluster near centers of human population because of the problem of transporting the milk and milk products. Feeds for dairy cattle near large industrial centers are not home grown, with the exception of the roughage.

Cattle Numbers and Number of People in United States

From 1860 to 1890 human population and cattle numbers moved forward together in the United States, there being approximately the same number of each. With the industrialization of our country the cattle population leveled off while the human population continued to increase. Up to 1890 the majority of the people lived on farms, but that time marked the beginning of the steady increase in growth of the urban population, while the rural population tended to remain stationary. The rapid growth of the large cities was coincident with the change in the rates of increase of the two populations which began about 1890. The increased efficiency in cattle production for both milk and meat made up in part at least for the difference in rate of increase.

World Cattle Population and Distribution by Continents

Cattle numbers are never static. An enumeration at any one time merely serves to indicate the extent of production in various continents or countries. Also, the population does not indicate the commercial production of either beef or milk. Cattle in India, for example, are not used for beef extensively as in South America. One other discrepancy should also be pointed out. Few countries use methods comparable to ours in estimating the cattle population. The following estimates are averaged where yearly estimates are available and are not comparable in time of year when the estimate is made or method of determination. In many instances they are probably but rough approximations.

CATTLE — NUMBER ON VARIOUS CONTINENTS,
1931-1935 AVERAGE¹

<i>Continents</i>	<i>Thousands</i>
Asia	268,300
Europe	106,900
South America	105,400
North and Central America	96,400
Africa	59,900
Oceania	17,300
Total for World including Soviet Union	697,900

The U.S.S.R. is not included in the separate continents as it is in two continents. Asia is first in total number of cattle (which includes buffaloes).

Cattle Population in Leading Cattle Countries

The United States is excelled in aggregate cattle numbers only by India (which includes buffaloes). The South American countries because of the excess production over their domestic needs are large factors in the world trade in beef. Some countries with fairly large cattle numbers contribute but little of cattle products to the world trade.

The following listing of cattle numbers in various countries is based on a five-year average where such was available. In many cases only one estimate was available for the period.

¹ *Agricultural Statistics, 1939*, pp. 310-312, U.S.D.A.

CATTLE — NUMBERS IN LEADING CATTLE COUNTRIES,
1931-1935 AVERAGE¹

<i>Country</i>	<i>Thousand Head</i>
India*	
British	154,211
Native States	50,515
United States	68,361
Brazil	44,178
U.S.S.R.	43,740
Argentina	31,540
China	23,000
Germany	19,134
France	15,616
Australia	12,865
Union of South Africa	10,497
Mexico	10,083
Siam	10,047
Poland	9,450

* Includes buffaloes.

Origin of Breeds

Our cattle breeds are mainly of European origin. The breeds are comparable to geographical varieties, and many are named for their native homes. Certain characteristics became manifest in cattle of the different areas which tended to distinguish them from other cattle. A desired type with desired features of form, color, horns, etc., was used for a pattern, and cattle of a common ancestry were selected and bred to meet the requirements. When a useful type was developed in a locality outside blood was no longer introduced and more intense breeding was practiced. As the number increased and more herds were established the next step was to form a record association so that the foundation stock would be registered and purebreds regarded as only those descended from the foundation individuals. Breeders usually formed organizations to conduct the record or herd book and also to advertise and promote the breed. Some records have been private enterprises.

The distinctive external characteristics of a breed which are rather uniformly transmitted constitute what is known as "breed type." It comprises the particular features that distinguish one breed from another. These features are not of great economic value in market stock production. Such things

¹ *Agricultural Statistics, 1939*, pp. 310-312, U.S.D.A. Average of five-year period if available, otherwise for any year or years within the period.

as shape of head, horns, carriage of ears, and color are examples. Breed type has a commercial value to the purebred breeder. In a way these features (such as the white belt on Hampshire hogs) serve as a trade mark, or distinguishing characteristic, which to some extent indicates pure breeding. Emphasis on features of breed type that are of little or no consequence may be harmful in selection when it diverts emphasis from more important characters.

Classification of Breeds According to Type

"Type" as rather widely used with reference to livestock means the principal use for which the kind has been developed. In cattle, for example, meat and milk have been the main ob-



FIG. 4. The present-day beef type. Shorthorn breeding bull, Sunray, grand champion Shorthorn bull at 1940 International Livestock Exposition. Owned by F. W. Hubbell, Des Moines, Iowa. (Carl Oldsen, Iowa Beef Producers Association.)

jectives. Each of these aims has been related to the form of cattle. The relation of type to production varies in different animals. Standards of perfection setting forth the physical characters, temperament, and other features which affect the efficiency for the principal objective or type are available. For each type these are made up in score card form. In addition to beef and dairy cattle, one group of cattle raisers has a twofold ideal which is called "dual-purpose type."

The beef type and dairy type cows are quite similar in internal anatomy and skeletal structure. The type difference is primarily the amount of fleshing and in the females the amount of secretory tissue in the mammary system.

Cattle are also used for draft purposes. For moving heavy loads on soft ground or on unprepared roads oxen are quite suitable. Under such conditions they also have a small usage as riding and pack animals. Although oxen are patient, steady, and strong they have yielded to horses and mules as draft animals on improved roadways.

The common breeds in the United States, classed according to type or purpose for which they have been primarily produced, are as follows:

<i>Beef Breeds</i>	<i>Dairy Breeds</i>	<i>Dual-Purpose Breeds</i>
Aberdeen Angus	Ayrshire	Devon
Brahman (Zebu)	Brown Swiss	Milking Shorthorn
Galloway	Dutch Belted	Red Polled
Hereford	French-Canadian	
Polled Hereford	Guernsey	
Polled Shorthorn	Holstein-Friesian	
Shorthorn	Jersey	
	Kerry	

These breeds were enumerated separately in the 1930 census, which also included a sizeable number (about as many as registered purebred Aberdeen Angus) as "other" and "unspecified" breeds.

Relative Numbers of Different Breeds¹

The registered purebred cattle were not determined in the sixteenth census (1940). The 18 breeds listed previously have changed in order of numbers from time to time even between the fourteenth and fifteenth censuses. During that ten-year period the number of purebreds increased, and all the dairy breeds increased. Some of the beef breeds lost in numbers while others increased. Breeds numerous today may not hold that position ten years from now. For many reasons the numbers change at variable rates; consequently, a count at any time is like a picture taken at the finish of a race and may not indicate standing

¹ The last report on registered purebred number is given in the *Fifteenth Census of the United States, 1930*, Vol. IV, p. 67. The U.S.D.A. reports annually in *Agricultural Statistics* the number of purebred dairy cattle registered by the various record associations.

at the previous or future time. In 1930 the breeds ranked in number of registered purebreds as follows: Holstein-Friesian, Hereford, Jersey, Shorthorn, Guernsey, Ayrshire, Aberdeen Angus, and Brown Swiss.



FIG. 5. The present-day dairy type. Holstein-Friesian cow, Montvic Rag-Apple Colanta Abberkerk, a notable producer and of desirable conformation. Owned by Mt. Victoria Farms, Hudson Heights, P. 2, Canada.

The U. S. Department of Agriculture obtains the new registration of purebreds annually from the cattle registry associations. For the period of 1931-1940 inclusive the breeds reported ranked as follows in the average number of registered purebreds.

<i>Breed</i>	<i>Average Registered per Year — 1931-1940</i>
Hereford	124,505
Holstein-Friesian	90,598
Guernsey	44,650
Jerseys	43,950
Shorthorn*	37,559
Aberdeen Angus	17,093
Ayrshire	13,016
Polled Hereford	6,691
Brown Swiss	6,610
Red Polled	1,634
Devon	219

* Includes beef, milking, and Polled Shorthorns.

Proportion of the Cattle Which are Purebreds

The registered purebred cattle represented 3.4 per cent of all the cattle in 1920 and 3.0 per cent in 1930. Difficulty in securing accurate data on registered purebreds caused this item to be omitted from censuses after 1930. Of the farms reporting cattle in 1930 (which was about three out of four) only 1 in 12 reported registered purebreds. There were purebred cattle that had been recorded with the various breed associations on about 394,000 farms.

With the growth of the cattle industry there was a great expansion in the production of purebreds. In production capacity there is little difference between high grades and purebreds. The use of purebred sires on a herd results in seven-eighths pure breeding in the third generation. The use of purebred sires increases rapidly the pure breeding in a herd, which is what happened during the period of expansion of purebreds. The emphasis has more recently shifted to improving the breeds rather than expansion of numbers, for there is a limit to the purebreds that can be sold to commercial producers at a profitable price. The commercial grower is now more interested in what improvement might be made with a new sire rather than the mere statement of pure breeding. In buying a bull for a high-grade herd the producer of commercial cattle wants a purebred that will improve his herd.

Chapter 3

BEEF CATTLE — GENERAL VIEW

Coincident with colonization, cattle of various types were introduced. With the extension of agriculture, cattle became distributed throughout this country to areas where feed supplies were available. In some areas cattle of the dairy type became the most numerous, and in other sections beef cattle, because of the nature of feeds, markets, or other factors, overshadowed the dairy cattle in numbers.

Areas of Beef Cattle Raising

Beef cattle production is of course varied for the different areas in which it is carried out. The raising of feeders is common in some sections, the feeding of baby beeves in others. This differentiation is based upon the relative production economy of the different classes of feeds. In areas where pasturage and roughage are relatively cheap, cattle are grown principally, while in sections with ample supplies of concentrated feeds more fattening is practiced. The 1940 census indicated that cattle were kept upon 79.5 per cent of all farms and that the average size herd was 13.3 head. Less than 10 per cent of the farms in the west north central states have no cattle. Iowa has the largest proportion of farms having cattle. The Pacific states have the greatest number of farms or ranches without cattle.

The various geographical areas in which different kinds of beef cattle raising or production are practiced are shown in Figure 6. The two distinctive areas are the western range, which is known as the great breeding ground, and the corn belt, in which native and western cattle are finished for market. Within each section variations of the common practice are noted. For example, heavy feeding is not wholly uncommon in the western range region, and pasturing and forage feeding are practiced more or less on farms in the corn belt. Within each large division several areas of specialized feeding exist, and

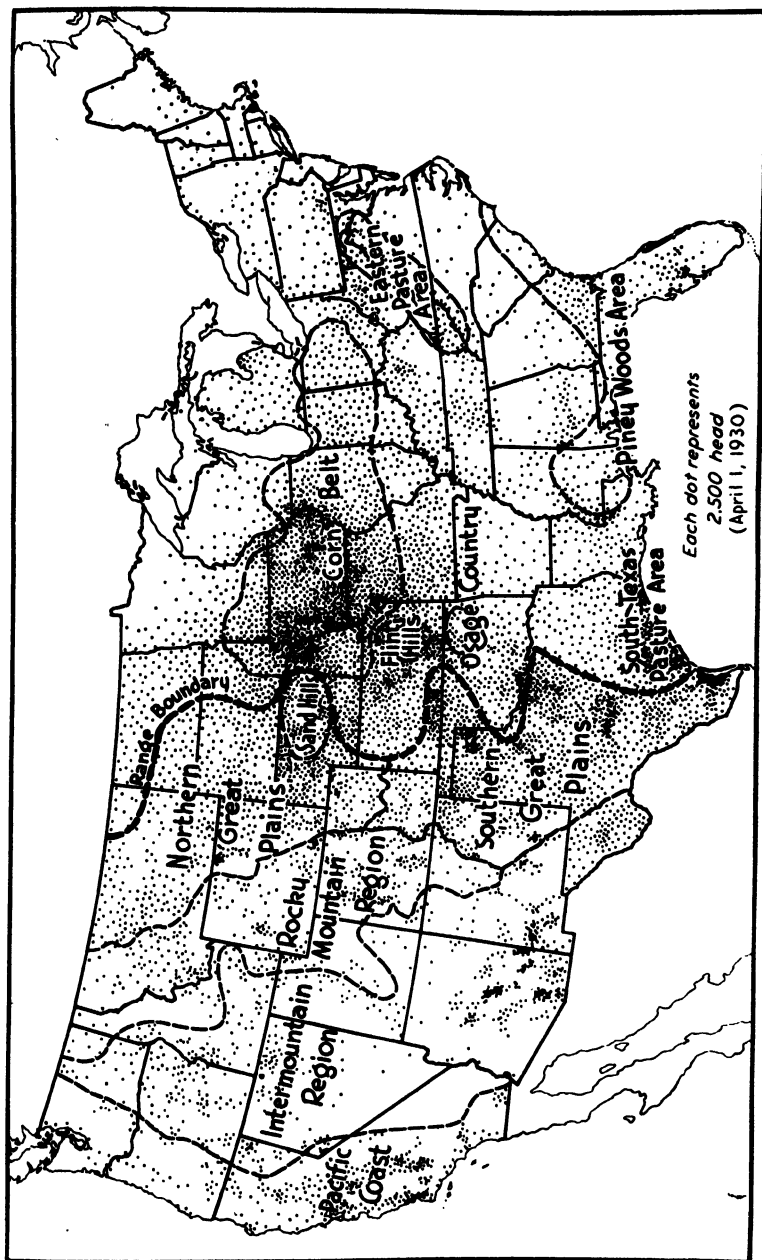


FIG. 6. The distribution of cattle in the United States and the areas of cattle production. (Cattle Handbook, National Livestock Marketing Association.)

there is continual changing and shifting of the cattle population in accordance with the feed situation. Droughts, for example, reduce cattle on the ranges.

THE WESTERN RANGE

The great plains, the Rocky Mountains, the intermountain and the Pacific coast regions comprise the western range country. In the 17 western states are found approximately 45 per cent of the total cattle population and 58 per cent of all beef cattle. More than 413 million acres in these 17 states are included in public domain, national forests, Indian reservations, and state lands, which provide the major breeding and grazing grounds for much of the livestock produced in the region. Further, 142 million acres of land are included under the federal "Taylor Grazing Act." In 1940 just under 12 million head of livestock were grazed upon this range land. Texas, Nebraska, Kansas, and Oklahoma are the states of heaviest beef cattle production, while the states in the intermountain area, Nevada, Utah, Idaho, and Arizona, have fewer beef cattle.

In this vast western area, with much range in vegetation because of varying climate, rainfall, and altitude, there is not an even cattle distribution. Also, cattle of various ages, finishes, and breeding are sent to the markets from the different areas.¹ The growing out of cattle on grass is the major line in the cattle enterprise, and as a consequence young cattle, mainly calves and yearlings, comprise the largest portion of their marketable receipts. Some of the steers, especially those with some age, may have sufficient finish to go direct to slaughter from the ranges, but the younger steers are most often fed before they are finally slaughtered. Feeding areas of a specialized nature are also prevalent in the western range country; for example, there are beet pulp feeding sections and a Texas cotton cake feeding section centered around the utilization of these by-products.

These feeding areas are concentrated in regions of available supplies of feeds because it is usually more economical to move the cattle to the feed than the feed to the cattle. It has been

¹ These specialized areas in the western range, indicating the producing and grazing sections and feeding areas, and approximate production of each, are shown in L. B. Mann, "Western Cattle and Sheep Areas," *Circ. C-103*, Cooperative Division, Farm Credit Administration, 1936.

estimated that the crop land and irrigated pastures in the range country provide 35 per cent of the feed consumed by range livestock.



FIG. 7. Beef steers raised on the western range and finished in the cornbelt. Champion Hereford load of steers at the 1941 International Livestock Exposition. Bred by C. DeBerard, Kremmling, Colorado. Fed and exhibited by Karl and George Hoffman, Ida Grove, Iowa.

About one-half of the cattle from the western ranges are sold for slaughter while the remainder are purchased for further feeding or grazing. In the early fall the unfinished cattle predominate in the western range receipts, and many of these are fed further before they are slaughtered for beef. Most of them go to feed lots for finishing on concentrates, others go to the farms for roughage and pasture feeding. The Flint Hills of Kansas, the Osage Pastures of Oklahoma, the Mineral Point region of Wisconsin, and the Appalachian or eastern grazing region are the better known of the grass fattening areas.

ALL CATTLE OVER THREE MONTHS OF AGE ON FARMS AND RANCHES IN 17 WESTERN STATES, APRIL 1, 1940¹

<i>State</i>	<i>Thousand Head</i>	<i>State</i>	<i>Thousand Head</i>
Texas	6282	New Mexico	843
Kansas	1163	Oregon	457
Nebraska	1256	Wyoming	740
Oklahoma	1104	Idaho	663
California	1128	Washington	698
South Dakota	1496	Arizona	638
Colorado	1144	Utah	374
North Dakota	1178	Nevada	339
Montana	1040	Entire U. S.	60,675

¹ From the 1940 census.

THE CORN BELT

In the corn belt area a different type of cattle raising prevails. Dairy cattle occupy a more prominent place and in beef production more intensive methods are followed. With a fertile soil, and ample rainfall for the growth of corn and other grains, general farming is practiced, and cattle raising is adapted to the type of agriculture. Smaller farms with higher priced land preclude the raising and grazing style of cattle production practiced on the western range. Cattle production is more intensive,

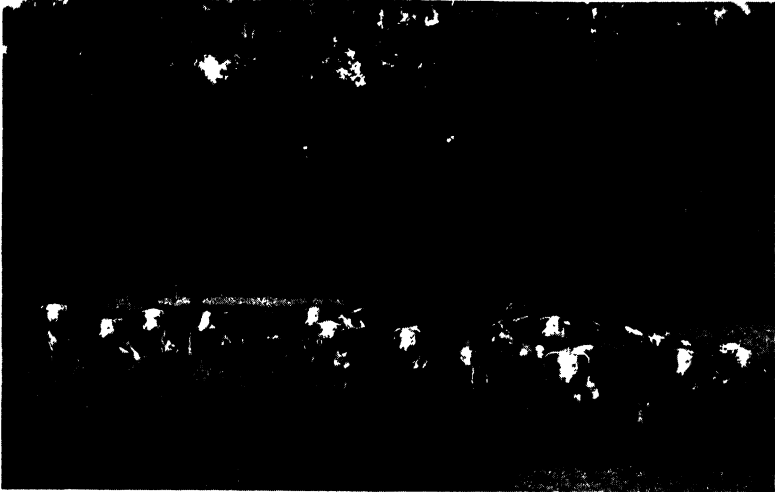


FIG. 8. A Hereford breeding herd on pasture in the Pacific region.
The C-B-Q Ranch, Fresno, Calif.

pastures are used, but to a less degree than in the range country, and much more fattening or finishing of cattle is practiced.

Beef breeding herds maintained in the corn belt produce finished young cattle for the market (baby beeves) or purebred breeding stock. The corn belt is unique in location, being between the range country and the centers of dense population which are beef-deficient sections. The natural marketing movement of cattle and beef is, in the main, from the west to the east. About 73 per cent of the cattle and 30 per cent of the human population are in the states west of the Mississippi. In the western regions there is a natural movement in the opposite direction. Many cattle in the eastward movement pass through

the corn belt and are fed out on corn belt farms. In addition, many cattle are raised and finished on these farms. Western range cattle further fed are absorbed principally in the corn belt. Some are further fed on roughage feed or pasture, others fed on concentrates for a short time, or warmed up, while still others are fully finished before returning as beef. The range country absorbs some of the purebred breeding stock (mostly bulls) from the corn belt section. These corn belt farms have productive pastures; in fact, the farmers who grow more than the average amount of grass have more livestock of all kinds than those below the average in grass production. An increase in the growing of pasture and roughage on cash grain farms is usually accompanied by increased numbers of livestock.

EASTERN STATES

Beef cattle represent but a small portion of the total cattle in the north Atlantic region, as dairy cattle predominate. There is some grazing of cattle on the blue grass pastures in the Appalachian or eastern pasture region. In this area, which includes part of Kentucky, Tennessee, Virginia, West Virginia, and North Carolina, cattle are fattened on pasturage principally, plus a relatively small amount of concentrates. There is a tendency to feed older cattle in this area, and usually cattle from this section are not the best in quality. The greater portion of these cattle are from the beef breeding herds within the territory. Some are sold as feeders, while others are sold fattened principally on grass on the farm where they were reared. The area around Lancaster, Pennsylvania, is of note as a cattle finishing section.

COTTON BELT — SOUTHERN STATES

Beef cattle in the southern states are outnumbered by those of the dairy type. The cotton belt is a nonspecialized region of cattle production with the exception of Texas and Oklahoma. Some cattle are kept on about three-quarters of the farms in this area. Much of the native stock is of dairy breeding, and some from cattle of original Spanish ancestry, which accounts for the less acceptable beef from this area. Unfavorable environment and inadequate rations account for the usual small size of the marketed cattle.

Proportion of Beef and Dairy Cattle Marketed

Wentworth¹ has studied the source of cattle receipts, determined by experienced observers, which represents the consensus of opinion of the trade at different markets, and reported on the proportions of beef and dairy cattle in these receipts. Dairy cattle predominate on those cattle markets serving regions of specialized dairy production such as Wisconsin, Minnesota, Ohio, Pennsylvania, and New York. On the corn belt and western markets, cattle of beef breeding predominate in the receipts.

A pooling of the percentages in a weighted average indicates that 68 per cent of the receipts are beef cattle, 14 per cent dairy cattle, and 18 per cent nondescript. Duplications which would bias the estimates in favor of the beef cattle occur, as some beef cattle are in the receipts first as feeders and stockers and later as finished cattle. Such duplication occurs less in the dairy and nondescript group.

Beef and Veal from Different Types²

It is estimated that about 50 per cent of our beef and veal supply comes from beef cattle, while dairy cattle, or herds kept for milk, furnish about 35 per cent of the entire volume. Dual-purpose cattle, or those kept for milk as well as beef production, contribute 15 per cent of the total supply. It should be pointed out that dairy cattle furnish most of our veal.

The proportion of beef derived from cows has been increasing because of the younger age and lighter weight at which other cattle, especially steers, are slaughtered. About 40 per cent of our total supply for meat from cattle that is both veal and beef comes from cows of dairy, beef, and dual-purpose herds.

Grain fattening is more general with beef cattle than with dairy cattle, as would be expected. High finish on dairy cattle brings much less return than on cattle of beef feeding. It has been estimated that not more than 25 per cent of the number of cattle slaughtered, exclusive of veal calves, are grain fattened.

Edward N. Wentworth, "Sources of Cattle Receipts," Part 1, *Armour's Monthly Letter to Animal Husbandmen*, Vol. 12, No. 6, September 1931.

² Estimates from *The Agricultural Situation*, Vol. 25, No. 9.

Probably under 40 per cent of beef bred cattle are grain finished, although a much larger proportion has had some grain.

Changes in Numbers of Cattle

Peaks in the cattle population occurred in 1891, 1905, 1918, and 1934, while lows appeared in 1896, 1912, and 1928. The average interval between peaks is 14 years and lows, 16 years. When cattle prices are relatively high, normal marketing of the production is restricted; more are held for breeding stock on the farms and ranches. With low prices for cattle there is liquidation of the breeding herds and marketings are comparatively heavy. Numbers vary because of these conditions and a cyclical movement in cattle numbers exists. The purchasing power of income from dairy cattle has tended upwards while that for beef cattle has remained horizontal for the last half century.

Changes in Number of Cattle of Different Types

Cattle in the census report are listed as milk cows and all cattle. The latter group includes, in addition to the milk cows, all other dairy and beef type cattle. Yearly estimates of these numbers are made by The Bureau of Agricultural Economics of the U. S. Department of Agriculture on January 1. From 1890 the number of milk cows increased until 1935. Even in years of recession of all cattle numbers, the milk cows showed increases. However, the tendency has been toward smaller increases. The tendency has been for the milk cows to show less resistance to declines in later years, and an actual decline came in 1935. The dairy cattle population appears less stable than formerly.

The change in numbers of all cattle on farms is due mainly to changes in the numbers of beef cattle. This fact is shown in Figure 9, which also indicates the cyclical movement of the cattle population. The increase in dairy cows has been quite regular while other cattle have tended down in numbers and have largely accounted for the cyclical movement in all cattle.

In comparing the human population with that of the cattle population we note a greater increase of the former. In other words, we have fewer cattle per capita than formerly. Although dairy cows have approximately maintained their numbers, other

cattle, which are principally beef cattle, have decreased in ratio. Increased use of dairy products in our diet is responsible for this

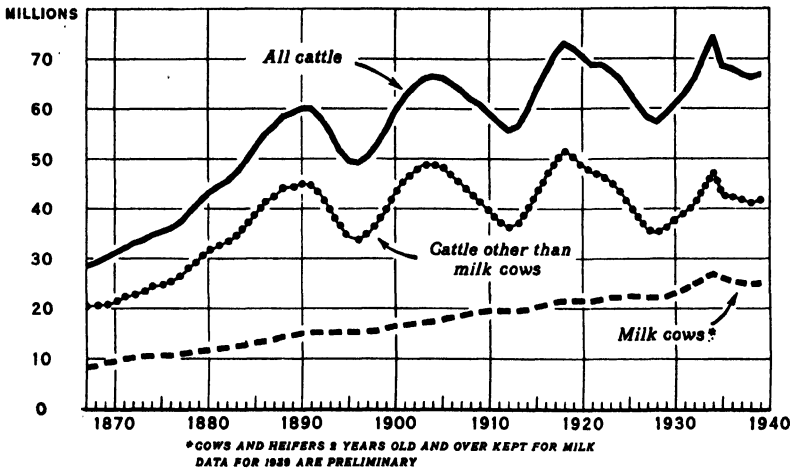


FIG. 9. Cattle numbers are changeable. Milk cows on farms have increased almost as fast as human population in United States. Cattle other than milk cows fluctuate more in numbers than milk cows. (U.S.D.A., Bur. of Agri. Economics.)

change. Per capita beef consumption has not changed materially, as the decrease in the cattle population has been offset largely by increases in the productive rate of our cattle.

Regional Trends in Cattle Numbers¹

We have seen that the general trend of cattle numbers in the United States has been upwards with cyclical movements. Cattle other than milk cows have been responsible for the increasing and decreasing numbers, as milk cows have been quite constantly increasing.

The regional trends have not coincided with the trends for the entire country. The year of largest numbers for all cattle east of the Mississippi River was 1939, while the peak for states west of the Mississippi and for the United States as a whole was 1934. Considering milk cows only, the peak year in numbers was 1934 for both the eastern and western states. In the group "cattle other than milk cows," the peak year for the eastern

¹ C. L. Harlan, "Regional Trends in Numbers of Cattle," *The Agricultural Situation*, Vol. 23, No. 3, B.A.E., U.S.D.A., March 1939.

states was in 1889, while the western states and the United States had a peak in 1918.

Show Ring Classification of Beef Cattle

In the show ring beef cattle are classed into breeding and market or fat cattle. At some shows classes are also provided for feeder cattle. Breeding classes are for purebreds, while market or fat and feeder classes are for purebreds, grades, and crossbreeds. In each division considerable disparity exists in the classifications at the different shows. Most of the livestock shows are held in the last half of the year, as the state fairs are generally held in the fall. However, there are some prominent livestock shows in the winter and early spring. Consequently classes and basal dates are not uniform. To make allowances for size differences, a show yard classification is made. In market or fat cattle this is based on weight or age and in breeding classes age is used. The tendency has been toward the elimination from the classification of older and heavier classes. At the 1940 International Live Stock Exposition the three classes for individuals (steer, spayed, or martin heifer) in the fat cattle division ranged in weight from 750 to 1400 pounds and the only limitation on age was that no animal calved prior to January 1, 1939, could compete. The competing individuals, therefore, were under two years of age and weighed under 1400 pounds. Group classes for fat cattle including carloads (15 head) were also included as were champions and grand champions. At some shows carload classes are available for breeding bulls and also heifers.

Beef breeding individuals at the 1940 International Livestock Exposition were divided into six classes for bulls and six classes for cows and heifers in the Hereford and Shorthorn breed. An additional class was available in each sex for older individuals (three years and older) in the Aberdeen-Angus breed. Group classes, as well as champion and grand champion classes, were included.

State fairs, livestock shows and expositions, district and county fairs publish premium lists or a preliminary classification, in which are listed the various livestock classes. They also include the rules and regulations. A prospective exhibitor ought to know and understand the show classification and rules.

Chapter 4

BEEF TYPE

As previously defined, type with reference to livestock denotes a kind of form, shape, conformation or general appearance which is related to utility. A typical form (such as is evident in beef type) common to a number of individuals of a kind or species is referred to as "type." In general, there is a relationship between form and performance. To the extent that this relation exists, the form can be used as a measure of value. In slaughter animals there is a fairly high correlation between form and carcass value. The value of a beef carcass, for example, is dependent upon its quality, conformation, and finish, which can be determined from the appearance of the animal on foot with a fair degree of accuracy. It is quite obvious that a thick, meaty beef carcass could not be secured from a slaughter animal that is lean and angular. The ideal of beef type implies not only high utility value of the carcass but also high acceptability of the steer from the producer standpoint. The ideal beef steer then is one that has made rapid and economical gains as well as being of high grade or market value for a slaughter animal. The qualities which indicate rapidity and economy of gains other than weight for age are rather intangible.

The judging, selecting, or evaluating of beef steers is on the basis of the individuality of the steer. This desirable individuality is a composite of the demands of the consumers of beef and the requirements of cattle producers or a sum total of those characteristics required in the makeup of an ideal animal. The ideal or standard of perfection sets forth the external features which affect the animal's commercial value. A steer making the maximum gain on the minimum of feed is desired by the producers, while the consumer wants good quality beef at reasonable cost.

*Detailed Description of the Ideal Beef Type***THE BEEF STEER SCORE CARD**

The score card is of value for teaching the beginner the various parts of the beef steer and their comparative value and also the terms used to describe the qualities of any part or parts. The finished beef steer is taken as the ideal as it is in greater demand than bulls, heifers, or cows on the finished cattle market, and consequently sells for higher prices. The score card for breeding animals is fashioned after the beef steer standard of perfection, as the model beef breeding bull or cow is one capable of producing a calf which, when finished, will be an ideal steer. The essentials of type are the same for steers, heifers, cows, and bulls.

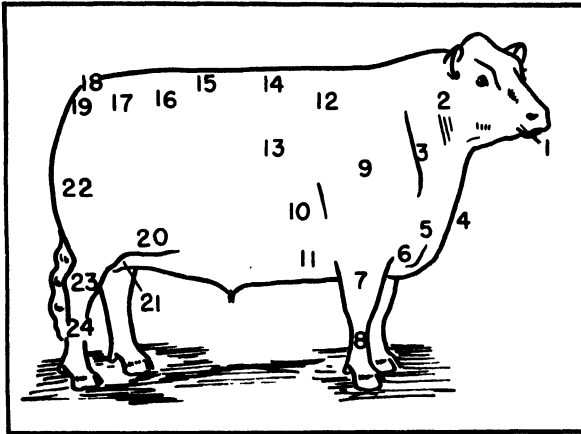


FIG. 10. Parts of the Beef Steer.

- | | | | |
|------------------|---------------|-----------------|------------------|
| 1. Muzzle | 7. Arm | 13. Ribs | 19. Pin bones |
| 2. Neck | 8. Shin | 14. Back | 20. Rear flank |
| 3. Shoulder vein | 9. Shoulder | 15. Loin | 21. Cod or purse |
| 4. Dewlap | 10. Chest | 16. Hook or hip | 22. Thigh |
| 5. Breast | 11. Foreflank | 17. Rump | 23. Hock |
| 6. Brisket | 12. Crops | 18. Tail head | 24. Shank |

The score card is a description of the external features of a model, or perfect, animal. Pictures, outlines, figures, and true type figures are likewise highly useful in depicting the ideal to the student so that perfection or the lack of it may be appreciated in the live animal. The parts of the steers are shown in Figure 10.

SUGGESTED STUDENT SCORE CARD FOR A MARKET STEER

Following is a score card suitable for a market steer in prime condition.

FINISHED MARKET STEER

Scale of Points

GENERAL APPEARANCE — 49 points:

1. WEIGHT — score according to age, estimate weight

6 months	450 pounds
12 months	850 pounds
18 months	1100 pounds
24 months	1300 pounds
30 months	1475 pounds

2. FORM — straight top line and under line, deep, broad, low set, compact, symmetrical, stylish, not paunchy

3. QUALITY — hair soft and mossy, hide pliable, bone, head, and horns fine, body and fleshing smooth and even, neither rolly nor patchy

4. CONDITION — degree of fatness, indicated by spinal covering, rib covering, fullness of purse and flank, proper texture and finish indicated by a mellow yet firm and springy touch

5. DRESSING PERCENTAGE — high condition, trim middle, thin hide, good quality

HEAD AND NECK — 5 points:

6. MUZZLE — broad, nostrils large

7. EYES — large, clear, quiet expression

8. FACE — short, clean cut

9. FOREHEAD — broad

10. EARS — medium size, fine texture

11. HORNS — fine texture, medium size, well shaped

12. NECK — short, thick, throat clean

FORE QUARTERS — 9 points:

13. SHOULDER VEIN — full, plump

14. SHOULDER — well covered with flesh, wide and smooth on top

15. BRISKET — neat and trim

16. LEGS — straight, wide apart, short, arm full, shank fine

BODY — 23 points:

17. CHEST — deep, wide, crops full

18. RIBS — long, well arched, broad across top, covered with thick, smooth, firm flesh

19. LOIN — broad, covered with thick, smooth flesh

20. FLANK — full, even with under line

HIND QUARTERS — 14 points:

21. HOOKS — well laid in and smoothly covered

22. RUMP — long, wide, level, smooth at tail head

23. THIGHS — plump, deep, wide and thick

24. TWIST — deep, plump

25. LEGS — straight, short, shank fine

Scoring of market steers is not common except in instruction work. For classroom instruction, students may score by listing the difference between the perfect score on each item and that allotted the individual being appraised, or the amount allotted each part can be listed. The summation or total score may be



FIG. 11. Grand champion steer at the 1941 International Livestock Exposition, Loyal Alumnis 4th. Bred, fed, and exhibited by Purdue University, Lafayette, Ind. A crossbred steer, sired by a purebred Aberdeen Angus bull and out of a purebred Shorthorn cow.

used in comparing different individuals. Ranking on each score card point is another method of score card use. In this method a final rating can be made which corresponds to the placing of the class. Score card judging is not applicable to comparative or show ring judging because of the time involved and because a proper balance of point emphasis may not be obtained. Recently the tendency has been to simplify the score card in the appraisal of farm animals.



FIG. 12. An ideal Aberdeen Angus steer. Mercer, grand champion of the International Livestock Exposition in 1938. Shown by Irene Brown, Aledo, Ill. (American Aberdeen Angus Breeders Association.)



FIG. 13. Sargo, a Hereford steer, grand champion at the 1940 International Livestock Exposition. Fed and exhibited by Evelyn Asay, Mt. Carroll, Ill. Weight, 1087 pounds.

SCORE CARD PARTS

The points of the score card will be discussed separately.

I. GENERAL APPEARANCE. The general appearance may be divided into weight, form, quality, finish, and dressing percentage. About one-half of the value of the steer is included



FIG. 14. Hereford steer, Columbian Red Top, grand champion at the 1940 American Royal. Shown by Columbian Steel Tank Co., Kansas City, Mo.

under general appearance, which deals with the outline of the steer.

(1) *Weight.* The capacity for weight increase is determined by heredity, while the feeding and management determine the extent to which that capacity is fulfilled. Heredity, then, sets the pattern, and the environment governs the extent of completion. Of all the items considered in evaluating market steers, weight for age is the most important from the producer's

standpoint because rapid gains are usually economical gains. As cattle are sold by weight, the buyer is not concerned with weight as it is related to age unless it influences the grade of the carcass. Slow-gaining, late-maturing beef cattle lack in quality of the beef. To the meat packer weight of a slaughter animal on foot is an important factor because it places the carcass in a weight class, which yields retail cuts of different weights and

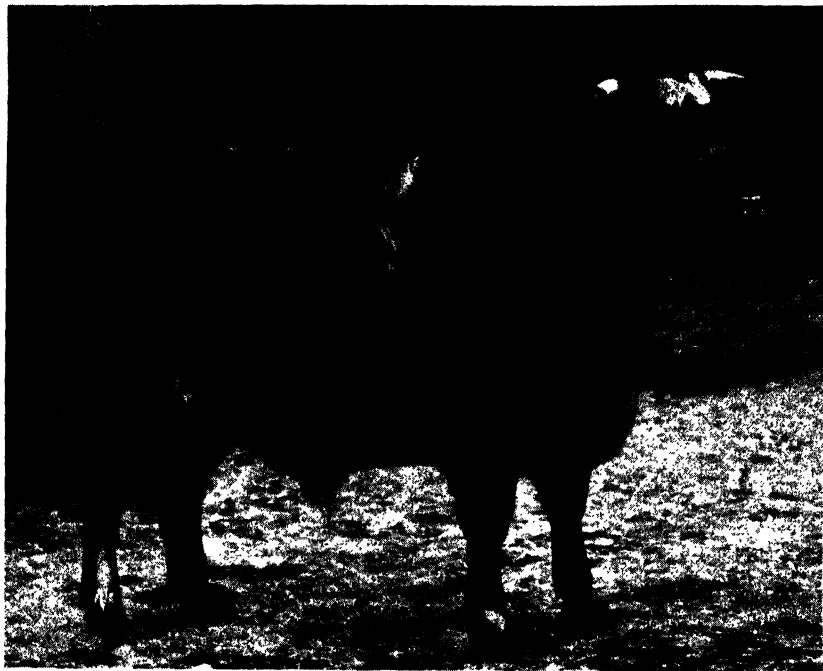


FIG. 15. A champion Shorthorn steer, Robin Hood, champion Shorthorn and reserve grand champion steer of the 1940 International Livestock Exposition. (American Shorthorn Breeders Association.)

finish. Though some heavy carcasses are in demand, the demand has been consistently shifting towards finished cattle of lighter weights. The International Live Stock Exposition (1940) limits show steers to a weight range of 750 to 1400 pounds, while at its beginning at the start of the century 2000-pound steers were often shown.

Sex, like age, is linked with weight as the males are heavier at all ages. Breed differences in weight are also present.

Following is listed a table of suggested ages and weights which may be regarded as a good standard for well-fed steers of different ages.

<i>Age, Months</i>	<i>Weight, Pounds</i>
Birth	80
6	450
12	850
18	1100
24	1300
30	1475

(2) *Form or Conformation.* When finished, the beef steer is broad, deep, compact, and low set. A poor steer in form is narrow, shallow, rangy, and leggy. A top-grade beef carcass in form is yielded only by steers that are wide, deep, short coupled, and short legged. Straightness of the top line, under line, and side lines is highly desirable. The top line is perhaps of importance only as it is related to appearance, but the side lines and bottom lines are of greater economic importance because they have to do with trimness of middle and balance of parts. A good beef steer must be balanced or symmetrical, that is, all parts must be uniformly well developed.

(3) *Quality.* The grader of beef carcasses attaches more emphasis to the item of quality than to any other single point. We want, then, in the beef steer to give attention to those features of quality which carry over into the carcass. Smoothness of form and fleshing are highly desirable. A soft, mossy coat of hair and pliable, not heavy hide are indicators of quality. A refinement of the head, horns, and bone also denotes quality. Refinement in this regard can be carried too far, because sufficient strength and ruggedness is a prerequisite to profitable performance in the feed lot.

A steer with a clean-cut head, not too heavy bone, fine hair coat, pliable hide that is free from roughness in fleshing, and smooth throughout is one with quality. From such steers high-quality carcasses are yielded. A coarse, rough steer will not produce a high-quality, attractive carcass which in the retailer's display case will have appeal to the buyer.

(4) *Finish or Condition and Fleshing.* Top-selling beef carcasses must carry a sufficient amount of fat. Consequently the market steer must be finished or high in condition. Lack of

finish is a common fault in market steers, yet overfinishing is not uncommon in heavy, older cattle. There is a demand for heavy, highly finished cattle, but it is rather limited. Finish beyond that desired by consumers is uneconomical because it is costly to produce and much fat must be trimmed off by the retailer before selling.

The finish of a steer may be appraised fairly accurately at some distance. However, close differences can be ascertained



FIG. 16. Placing the grand champion steer, Junior feeding contest, 1940 International Livestock Exposition. To the left is the champion Aberdeen Angus, shown by Lisle Mullins, Winterset, Iowa. To the right is the champion Shorthorn shown by Herbert Reese, Knoxville, Iowa, and center is Sargo, champion of the Junior division and also grand champion steer of the entire show. Shown by Evelyn Asay, Mt. Carroll, Ill.

only by handling. The spinal and rib covering and that on the point of the shoulder indicate the fatness, as well as the fullness of the flank and purse (scrotum after castration). The handling of the fleshing should be mellow yet firm and springy. The covering of flesh may be too soft or too hard as well as insufficient.

Fleshing that is fat and lean is to the consumer the major economic feature of beef. Muscling with sufficient fat surround-

ing it and intermixed between the muscle fibers and that is tender and tasty is the demand of the beef consumer. Lean meat or muscling is commonly referred to as "natural fleshing" by the cattle raiser. See Figure 17. Uniform, heavy fleshing which is mellow to the touch, thick over the back, ribs, and loin, and heavy in the rounds in the steer on foot give the fleshing required in a top carcass.

(5) *Dressing Percentage.*

Cattle that are highly finished, trim middled, and light in the hide, shanks, and head will yield a relatively high proportion of carcass when slaughtered. As the carcass is worth more per pound relatively than the by-products, a high carcass yield adds to market value. Although light - middled, fine - boned steers may dress high, it is quite obvious that these qualities can be carried too far, economical production considered. There is a medium ground; we want evidences of high dressing, yet it must be compatible with productive characters such as capacity to consume feed, and ruggedness.

II. HEAD AND NECK. Of all the main divisions of the score card the head and neck are allotted the fewest number of points and are probably of minor consequence in the meat value of a slaughter beef animal.



FIG. 17. Veal carcasses, showing type differences. The carcasses are from calves slaughtered when less than a week of age. Heavy muscling as is shown by the carcass on the left is typical of the beef type. Calves of dairy breeding have carcasses such as the one on the right.

(6) *Head*. A medium-sized head is suggested under quality. In shape a rather short, wide head with a broad muzzle is desired. By the appearance of the head the temperament and disposition may be estimated. A lymphatic temperament and quiet disposition are the attributes of a good feeding steer.

(7) *Neck*. A short, thick, muscular neck clean at the throat is required in a good steer. Such a neck is compatible with the general requirement in form. A long-legged, rangy steer would have a long, thin neck.

III. *FORE QUARTERS*. The fore-quarters on the live steer on the score card are not comparable with the fore-quarters on the beef carcass, mainly because a section between the fore and hind quarters is designated as "body." The fore quarter is a section of lesser value than the other portions except the head and neck.

(8) *Shoulder Vein*. The junction between the neck and the shoulder is blended together at the shoulder vein. This part is full and plump in a good steer so that no marked division can be noted.

(9) *Shoulder*. Briefly the shoulder, as it is the source of a wholesale cut of wide demand, should be well covered with flesh, wide and smooth on top. A smooth blending of this part with the others is desired. Heavy, rough shoulders, opened too wide on top, are not uncommon.

(10) *Brisket*. A minimum of brisket is wanted in a slaughter steer because this is one of the lowest priced cuts. Consequently a neat, trim brisket is suggested for the ideal.

(11) *Legs*. Actually the legs are of little consequence when the steer is finished, provided they are ample to carry him on marketing across the scale. However, usefulness in the feed lot is based on adequate legs, and style is influenced by the legs. Straight short legs set wide apart are desirable and a well-developed muscular arm is preferred.

IV. *BODY*. The body embraces some of the important high-priced cuts and is as a consequence a division which receives nearly one-fourth of the points on the score card. In general, great width should typify the ideal steer, but shortness is desired in body length. Compact or short-bodied slaughter cattle yield carcasses which have the desired form.

(12) *Chest.* The chest is that portion between the shoulders and immediately behind them and includes the part called the crops. Great width and depth with well-filled crops are required. In fact, a steer cannot be too wide or deep in the chest. The girth of a steer just back of the fore leg is the heart girth. A large heart girth indicates constitutional vigor.

(13) *Ribs.* As commonly used the ribs include the back. On the carcass this portion is the wholesale cut of beef known as the ribs. A straight, wide back is desired, and in usage this term is restricted to the top part of the ribs from the shoulders to the



FIG. 18. A grand champion carload of finished steers. Grand champion load of steers, 1940, International Livestock Exposition. Aberdeen Angus steers fed and exhibited by Schmidt Bros., Delmar, Iowa.

beginning of the loin at the last rib. As this portion yields one of the higher priced beef cuts, it should be heavily, smoothly, and firmly fleshed. The thickness of the flesh is determined by a touch with the palm and fingers.

(14) *Loin.* The loin extends along the top line from the ribs back to the hip or hook. The beef cut loin extends somewhat farther back on the carcass than on the live steer, as indicated in Figures 10 and 44. The specifications used for the ribs or back hold for the loin. When broad, heavily fleshed, and smooth, it complies with the requirements. Of the wholesale cuts the loin is in the greatest demand and sells for the highest price

per pound. Along the top line, especially on the rear part of the back or the forward part of the loin, there may be adhesions of the hide to the vertebrae, and a depression in the fleshing develops as the animal is fattened. Such a depression is called a "tie."

(15) *Flank*. A flank that is full and even with the under line is desired in the fattened steer.

V. HIND QUARTERS. The hind quarter on the score card is not comparable with that on the carcass as the latter includes all portions back of the ribs. On the score card the hind quarter includes all parts posterior to the loin. This division is mainly the beef round on the carcass.

(16) *Hooks*. The prominence of the hips is known as the "hooks" in cattle. A finished steer should not have a visible prominence of the hooks. An inconspicuous, smoothly covered hook is desirable.

(17) *Rump*. The part of the steer along the top from the hook to the tail head is known as the rump. A part of this is included in the wholesale beef cut, the loin, and the remainder is made up of the rump. A long, wide, level rump which is smoothly fleshed is desired. Often finished cattle are rough and patchy at the rump and tail head.

(18) *Thighs*. The outer part of the round which is below the rump is termed the thigh. It should be plump, deep, wide, and thick. Too often beef cattle are light in the hind quarters or not uniform in width. When narrow behind or high in the thighs, a light round in the carcass results. Plumpness is desired as a short shank of round gives a larger proportion of round that can be merchandized as round steak.¹

(19) *Twist*. The inner thigh is termed the twist and is a contributing portion to the beef round. It should be deep from the tail head and also plump.

(20) *Legs*. The hind legs, as the fore legs, should be ample to carry the weight of the finished steer. In the good steer they must be short, straight, and not too heavy in the shank. As in the front legs, ample bone is needed but it can be excessive.

¹ An abnormality termed "double muscled" appears occasionally in cattle. It is identified by the thickness and fullness of the thighs, with deep grooves between the muscles.

Procedure in Judging Beef Cattle for Market

The essential steps in judging livestock or placing a class are as follows:

1. Knowledge of the ideal.
2. Observation and examination of the individuals.
3. Comparison of the individuals in the class.
4. Ranking, conclusion or judgment.
5. Explanation for placing, or reasons.

In proceeding with the placing of a class of cattle, it is suggested that first a general survey be made of the entire group



FIG. 19. Grand champion three steers, get of sire, at the 1941 International Livestock Exposition. Bred, fed, and exhibited by Iowa State College, Ames, Iowa.

of cattle by walking around and observing them from some distance. The general features, such as weight, form, quality, and condition, are appraised in a general way. This is followed by a more detailed study or inspection of each individual in the class at closer range from the side, rear, and front. Finally, by handling, the fleshing is appraised, as well as some features of quality. The amount and smoothness of the flesh are determined by touch or handling of the rib, back, loin, shoulder, and spinal covering.

Weight Estimates from Measurements

A method devised by Johnson¹ makes possible the estimate of weight from body measurements. The accuracy has been tested on the common breeds of cattle including fat or finished cattle and feeder cattle. The greatest error with any group was 5 per cent, and for 431 head the error was 3.6 per cent.

Two measurements are used. They are, (1) the heart girth taken directly behind the shoulders, and (2) the length taken from the pin bone to the prominence on the shoulder, which is located in mature cattle one inch back of the point of the shoulder. The latter measurement is taken with the animal standing squarely on its feet with its head straight forward. The heart girth measurement is not influenced materially by the position of the animal.

The formula follows:

$$\frac{(\text{Heart girth, inches})^2 \times \text{length, inches}}{300} = \text{weight in pounds}$$

For example, if the specimen of cattle taken had a heart girth of 80 inches and a length from shoulder prominence to the pin bone of 60 inches, it would have an approximate weight of 1280 pounds.

Age of Cattle as Determined by the Teeth²

Cattle when mature have eight incisor teeth on the lower jaw. On the upper jaw a dental pad occupies the place of the incisors. Age may be estimated from the appearance and wear of the permanent or second incisor teeth. A calf at birth has two or more of the temporary incisors, and in a month's time all of the temporary incisors have made their appearance. The center pair of temporary incisors will be replaced by a pair of permanents at 15 to 18 months, and these are up in wear at 2 years. The intermediate or second pair of permanent incisors appear at 2½ years and are fully developed and in wear at 3 years. At 3½ years the second intermediates or laterals appear, which are mature at 4 years. At 4½ to 5 years the corner incisors are

¹ D. W. Johnson, "Livestock Weights from Measurements," *Extension Folder 70* Minn. Agr. Ext. Division, May 1939.

² George W. Pope, *Farmers' Bull.* 1066, U.S.D.A., August 1919.

replaced, and a full set of permanent incisors in wear is typical at 5 years of age. Beyond this age the incisors show signs of wear, and the shape of the wearing surface is changed, being more triangular as the teeth are worn down and are distinctly separated. Also there is less arch or curvature of the teeth forward as age advances.

Slaughter Steer Grades Determined from Weights and Measurements

A method for determining the slaughter grades of steers from weights and measurements has been devised by Knapp.¹ The



FIG. 20. The rear view of a champion steer herd. Aberdeen-Angus steers shown by the Iowa State College, Ames, Iowa.

use of these methods would permit the inexperienced grader to estimate quite accurately the market grade of slaughter steers by weights and measurements. For example, a steer measuring 44 inches high at the withers with a weight between 716 and 828

¹ Bradford Knapp, "Determination of Slaughter-Steer Grades from Weights and Measurements," *Cir. 524*, U.S.D.A., May 1939.

pounds would class as Good. With greater weight the grade would be Choice or Prime, and for a lesser weight the grade would be Medium or Plain. As the height of the steer at the withers is increased the weight is increased as would be expected. Better grades outweigh the poorer grades. However, beyond a certain height additional height is accompanied with a lowered market grade. So a tall steer would grade low even though he was finished.

Two measurements, height of withers and heart girth, are also related to market grade. A steer 44 inches tall at the withers and with a heart girth of $63\frac{3}{4}$ to 68 inches, for example, would grade Good whereas steers of larger girths would grade higher and those with smaller girths would grade lower. Further relationships between market and weight, weight and heart girth are given in the circular. These are based on a study of 167 steers of Hereford, Shorthorn, Aberdeen-Angus, and dairy breeding.

Chapter 5

CATTLE MARKETS

In the movement from the producer of livestock to the consumer of meat various different agencies are involved. In some instances these number only a few — for example, the cattle raiser may slaughter and sell or barter the carcass direct to consumers. However, this is a rather simple case. Most beef must move some distance to the consumer because the surplus beef producing areas are in the midwestern section of our country and the movement is toward the east, with some movement to the deficit areas on the west coast. Cattle when marketed for beef may pass through a central market or direct to the meat packer. After processing, the meat moves through various channels to the consumer.

The marketing system is not static. Changes are continually being made. The avenues through which beef or other meat moves are constantly shifting not only in response to new surplus and deficit areas but also by changes in marketing methods. Up until the time of the First World War the tendency was toward centralization of marketing and slaughter. Since then there has been a marked inclination toward decentralization.

Methods of Disposing of Livestock

The producer of livestock is confronted with a perplexing problem of where to market his livestock as he usually has a choice of many outlets. In order to select intelligently the best market, the seller must have considerable information at his disposal. He must know the relative costs of marketing for the different available markets so that comparisons can be made on the basis of net returns. Likewise if the cattle man has a knowledge of the market classes and grades he can evaluate his cattle.

Following are the common methods of disposition of livestock:

1. They may be sold to the local livestock buyer.
2. The owners in certain localities pool their livestock and ship it cooperatively. These are known as "livestock shipping associations."
3. Livestock may be sold through a local auction sale barn. This outlet has increased greatly in usage in certain sections, and there are seasonal auction sales, especially where feeder cattle are sold.
4. A sale may be made direct to meat packers either at the plant, at their concentration yards, or to their buyers in the field. Direct marketing is defined for slaughter animals as sale to slaughterers at places other than the central livestock market, where the services of a commission company are employed by the seller.
5. Livestock may be shipped to a central market, consigned to a commission company, which acts as the owner's agent and makes the sale.
6. Livestock are at times consigned to slaughter and the settlement made on the basis of the sale price of the carcass.
7. Local butchers or feeders may purchase the livestock direct from the owners.
8. Home slaughter is practiced, and to some extent there is sale or barter of that not used for home consumption.

Early Cattle Markets

As cities developed in this country, a market for beef was created. Prominent early cattle markets were at Philadelphia, Baltimore, Boston, New York, and Albany. It was not until the beginning of the eighteenth century that cattle were taken from grazing areas to urban centers for slaughter. The cattle were driven from the cattle growing sections to the large cities on the eastern seaboard. These cattle were sold at markets already established for eastern cattle near large cities. George Renick in 1805 drove 50 head of large heavy steers from the Sciota Valley in Ohio to Baltimore, where they were disposed of through the city butchers. Following this original trailing of cattle droves, numerous others followed, and it was not until

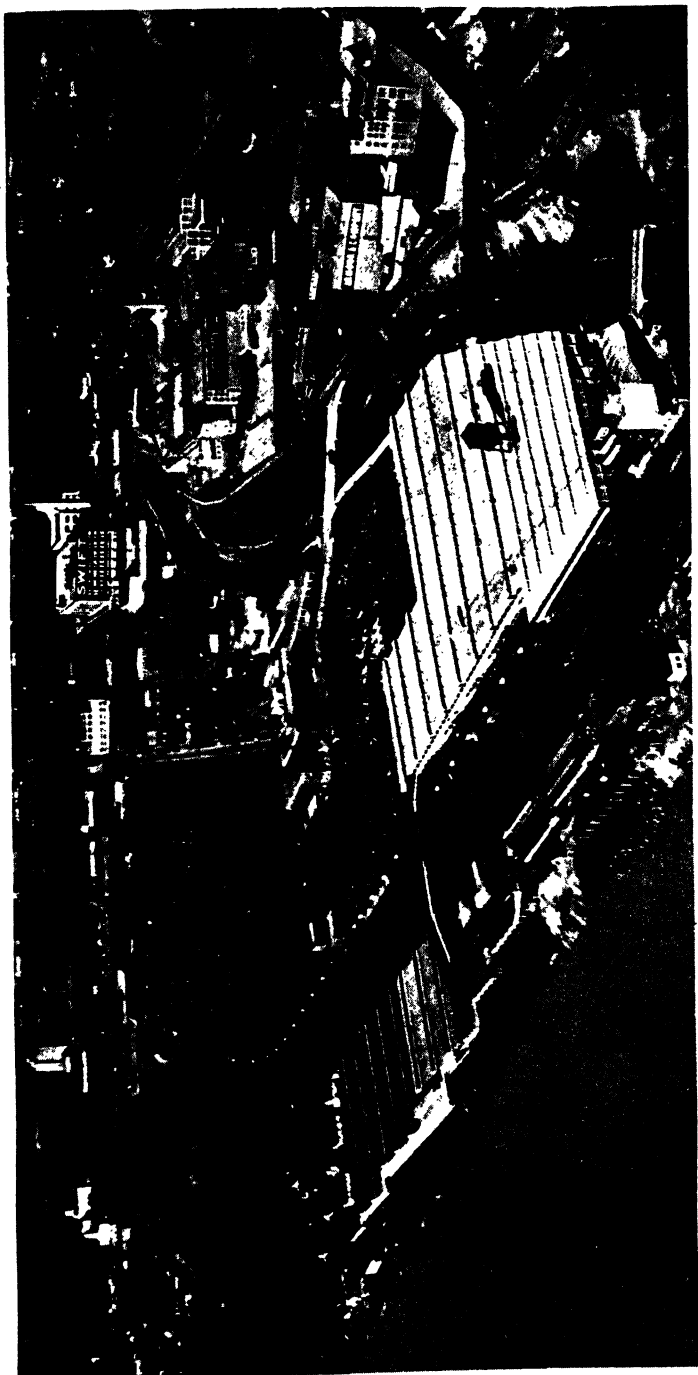


FIG. 21. The Sioux City stockyards and "Packingtown." The hog barns are in the center foreground. Beyond are the cattle pens which adjoin the hog barns on the north. The large building partially surrounded by the cattle pens is the Live-stock Exchange Building. To the left on the banks of the Missouri River is the sheep barn. To the right there are the packing plants of Armour, Cudahy, and Swift. The Sioux City yards cover 80 acres of ground and have a capacity for 25,000 cattle, 40,000 hogs, 25,000 sheep, and 1000 horses and mules.

the advent of rail transportation that trailing ceased. Rail shipment began soon after 1850, but was supplemented with trailing to points of shipment, and until the year 1880 extensive trailing of cattle was practiced in southwestern United States.

The drovers of cattle passed on information to one another about the cattle markets. Those returning from the market would advise those with incoming droves as to the source of the strongest bids and the general condition of the market. From this developed the plan of one staying on the market and charging a fee for bringing the seller and buyers together. The next step was the development of the livestock commission companies.

Cattle Trailing

As cattle raising moved westward, the distance from the large eastern markets was increased. As the frontier was pushed west and agriculture went west with the settler, greater distance separated the livestock grazing and feeding areas and the meat-deficient area on the eastern seaboard. Often trailing was interrupted for cattle from the midwest areas like Illinois with a feeding period in the grain crop producing area of Ohio. Fat cattle shrink heavily in trailing, and with the settlement of the country the practice became inconvenient and uneconomical. The development of railroad transportation afforded the cattle grower a greater accessibility to markets for fattened cattle. The drover continued to operate beyond the transportation lines and brought in livestock to the market on the railroad.

Railroad Transportation of Cattle

The first experimental attempt to ship live cattle by rail was in 1852, but it was not until 1860 that much livestock was transported to markets by railroads. Railroad centers then became the seats of central or terminal markets in many instances. The extension of the railways into the grazing areas extended the raising of livestock and caused a gradual increase in livestock numbers.

Although motor trucks have reduced the number of livestock shipped by rail, in 1941 over 75,000 carloads of livestock were received at the Union Stockyards, Chicago.

Water Transportation and Cattle Marketing

When livestock production moved over the Allegheny Mountains, the major portion of the animals was marketed by trailing



FIG. 22. Buying finished slaughter cattle in the Chicago Union Stockyards, Chicago. (Swift and Co.)

until railways were developed. Water transportation also entered into the early market picture, as shipping by boat down the Mississippi and the Ohio and up the Atlantic coast provided an outlet for live animals and cured meat.

With the growth of water transportation on the Great Lakes and numerous canals, some meat was shipped by boat to the

east, especially through the Erie Canal. The Civil War closed off the Mississippi route, and soon thereafter the railroads opened up shipping facilities for the midwest.

Development of Centralized Marketing

Following the Civil War there developed the central marketing system. Livestock was consigned to large terminal markets such as were located at Chicago, Kansas City, and elsewhere. On these markets commission merchants representing the owners sold the livestock to large packing plants near or at the central market or to small plants there and elsewhere. The smaller plants, especially those at or near the eastern markets, were represented on western markets by order buyers. Many central markets developed in the midwest, and the slaughter cattle converged toward these markets in the eastward movement and spread out in fanlike shape after passing through these markets. The majority were slaughtered at or near the terminal market.

A public livestock market or central market is one which complies with certain federal government regulations. On such livestock trading centers facilities are provided for receiving, caring for, and handling livestock; the privileges of buying and selling livestock are available to all. There are about 100 markets in this category, and 67 are reported regularly in the U. S. Department of Agriculture monthly reports, "Crops and Markets."

Where Slaughter Cattle Are Raised

The various areas of cattle production have been previously discussed. The surplus and deficit areas in beef production are shown in Figure 23. Cattle are raised in areas where production is low cost and efficient. This involves greater costs in getting the beef to the consumer as these areas are some distance from the centers of consumption, but since this is overshadowed by lower production cost, the total cost to the consumer is less.

Large Cattle Markets

The central markets vary from year to year in their total receipts. When cattle numbers are lessened in an area served by a central market, the receipts are, of course, reduced. This

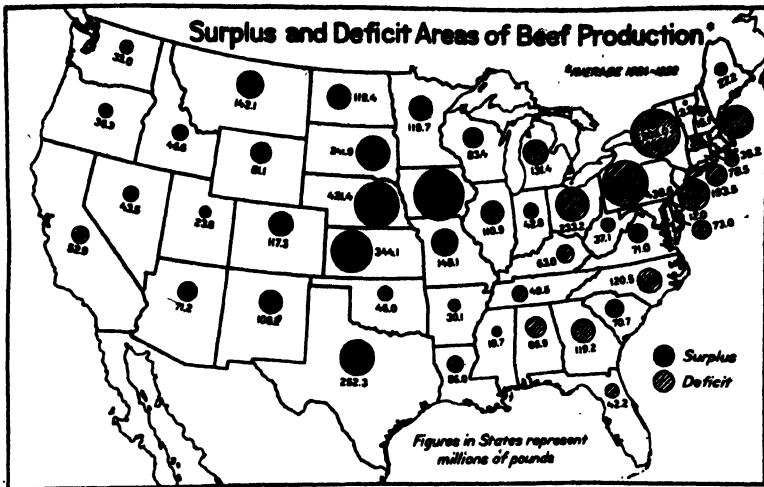


FIG. 23. Surplus and deficit areas of beef production. It will be noted that Iowa, Nebraska, Kansas, and Texas have a large surplus of beef. The eastern states with large populations are deficit areas. (U.S.D.A., Bur. of Agri. Economics.)

is usually preceded by heavy receipts because of liquidation. Chicago, because of its location, has long been a large cattle market. Although there are 100 officially recognized public markets, the 12 principal markets are within or adjoining the corn belt.

Following is a list of the larger central markets and their cattle receipts for a ten-year period.

LARGE CENTRAL MARKETS FOR CATTLE

Average Yearly Receipts for the Ten-Year Period, 1930-1939¹

Market	Average Yearly Receipts, Thousand Head
Chicago, Illinois	2122
Kansas City, Missouri	1606
Omaha, Nebraska	1417
South St. Paul, Minnesota	931
East St. Louis, Illinois	886
Sioux City, Iowa	776
Fort Worth, Texas	655
Denver, Colorado	490
St. Joseph, Missouri	403
Pittsburgh, Pennsylvania	315
Indianapolis, Indiana	290
Wichita, Kansas	289
Los Angeles, California	285

¹ Data from Agricultural Marketing Service, U.S.D.A. Source, *The Drovers Journal Yearbook of Figures*.

Large Calf Markets

Calves on the central markets are listed separately from cattle. Such calves are approximately under 400 pounds in weight. This includes veal calves and also other individuals under one year in age and weighing less than 400 pounds. Following is a list of large central calf markets and their receipts for a ten-year period.

LARGE CENTRAL MARKETS FOR CALVES

Average Receipts for the Ten-Year Period, 1930-1939¹

<i>Market</i>	<i>Average Yearly Receipts, Thousand Head</i>
South St. Paul, Minnesota	566
Chicago, Illinois	493
East St. Louis, Illinois	492
Jersey City, New Jersey	476
Milwaukee, Wisconsin	454
Kansas City, Missouri	363
Fort Worth, Texas	349
Pittsburgh, Pennsylvania	326
Buffalo, New York	260
San Antonio, Texas	148
Omaha, Nebraska	148
Oklahoma City, Oklahoma	133

Holdover Cattle

Livestock unsold when trading stops at 3 P.M. are held over and sold at the next marketing period. These holdovers are believed by some to have a depressing effect upon the market price the following day. Investigations have failed to reveal any significant relation between holdovers and price movements.

The Chicago Livestock Market

A stockyards near Myrick's Tavern three miles south of Chicago was started in 1837. A cattle market in Chicago known as the "Bull's Head Yards" was opened in 1848. The present Union Stockyards began in 1865 and it supplanted the seven scattered markets then in existence in Chicago. John B. Sherman organized the Union Stockyard and Transit Company in that year, and 320 acres of land were purchased at 39th and Halsted Streets. Gradually the facilities for the market were

¹ Data from Agricultural Marketing Service, U.S.D.A. Source, *The Drovers Journal Yearbook of Figures*.

expanded. The stockyards now has an area of over 500 acres.

In 1865, the first year of operation, the cattle receipts of the Union Stockyards at Chicago numbered 613 head. The growth in receipts was rapid, and by 1876 the yearly receipts numbered over 1 million head. The 2 million mark was reached in 1887 and 3 million in 1889. The largest yearly receipts were in 1918 when 3,789,922 cattle, exclusive of calves, were received at the yards. Calves had their year of heaviest receipts in 1925 when 847,762 passed through the yards.

Receipts of cattle and calves at the Chicago market have

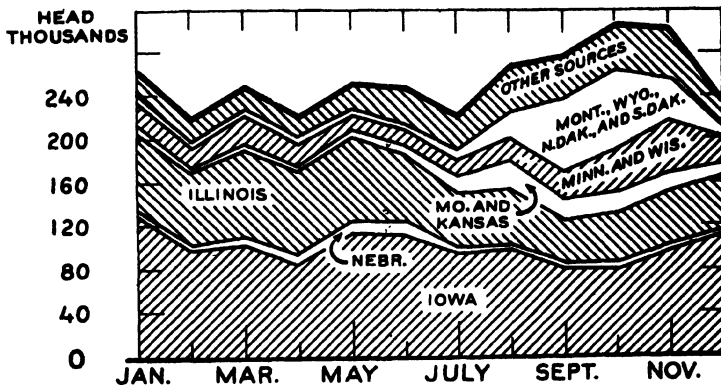


FIG. 24. State origin of cattle receipts at Chicago, Union Stockyards Market. The receipts from the western states swell the receipts in the fall of the year. (U.S.D.A., Bur. of Agri. Economics.)

lessened. From 1917 to 1926, inclusive, the yearly total of cattle receipts fell under 3 million head but once. From 1927 to 1938 the yearly receipts of cattle have been in the 2 millions all years except three, when they were just under the 2-million mark. The state origin of cattle receipts on the Chicago Market is shown in Figure 24.

In 1939 the yearly receipts and shipments from the Chicago market were as follows:

	<i>Receipts</i>	<i>Shipments</i>
Cattle	1,818,494	560,251
Calves	312,052	24,893
Hogs	4,263,810	468,365
Sheep	2,498,869	488,213
Horses	7,948	6,002
All kinds	8,901,173	1,574,724
Carloads	81,193	24,015

Chicago Market — Grand Totals of Livestock Handled

The size of the Chicago market can be appreciated from the magnitude of the receipts and shipment during the 74 years of its existence.

GRAND TOTAL — 74 YEARS LIVESTOCK RECEIPTS AND
SHIPMENT, UNION STOCKYARDS, CHICAGO, ILLINOIS

Up to 1939, Inclusive

	<i>Receipts</i>	<i>Shipments</i>
Cattle	170,341,054	63,347,882
Calves	22,765,226	1,813,151
Hogs	478,344,768	114,972,935
Sheep	211,016,006	52,484,350
Horses	3,981,616	5,579,359
Total	886,448,670	236,197,677

Central Markets and How They Function

At the central or terminal markets the facilities for buying and selling are available for all. There are several organizations which operate on the usual central market. The stockyard company, transportation company, commission agencies, and buyers combine in making a central or terminal livestock market. Following is a discussion of these organizations as well as their functions.

STOCKYARD COMPANY

The land, yards, and equipment for unloading and handling the livestock are owned by the stockyard company. Employees of this company unload, count, yard, feed, and water the livestock and the company also provides weighing facilities. The stockyard company derives its income from a yardage fee and the sale of feed. Yardage is higher for truck shipments than rail shipments because of the smaller droves. At the Union Stockyards in Chicago the yardage is 35 cents per head for cattle and 20 cents for calves from rail receipts. Feed prices charged are changed from time to time dependent upon feed costs.

STOCKYARD TRANSPORTATION COMPANY

This company provides the equipment for moving the cars of livestock from the tracks of different railroads to the unload-

ing docks in the stockyards. It handles the outgoing as well as the incoming shipments. The charges are made on the car basis.

COMMISSION COMPANIES OR ORGANIZATIONS

On the central market the services of commission companies are usually utilized by the owners of the livestock. As they charge a fee for their services in proportion to the number sold, they are called "commission companies." There are also farmers' cooperative commission organizations that function in the same capacity. Salesmen from these concerns represent the owners of the livestock, as they are familiar with market trading and market conditions. They also represent the livestock feeders in making purchases of feeder cattle. The stockyard company allots blocks of pens to each commission house in which livestock consigned to them are penned by the stockyard company employees. At the Union Stockyards, Chicago, Illinois, the maximum charge for cattle and calves in one consignment or under a single ownership is \$20.00; if the car is double decked, as is the case sometimes for calves, the maximum is \$25.00. On an individual animal basis the charge is as follows:

	<i>Weight Range, Pounds</i>	<i>Commission, per Head</i>
Calves	400 down	\$0.45
Lightweight cattle	400-800	0.80
Medium-weight cattle	800-1200	0.90
Heavyweight cattle	1200 up	1.00

There is a scaling down of commission charges per head in consignments of more than one head.

BUYERS

Many kinds of buyers are on the central stockyards markets. Following are the common groups.¹

a. Packer buyers. These representatives of the meat packing plants purchase livestock for slaughtering plants, of which several are near the markets.

¹ In June 1940, W. S. Clithero of Armour and Co. stated that on the Chicago market there were 39 cattle buyers for the three large packers, 32 men buying for the 12 local small packers, 44 order buyers for packers all over the country, 23 to 32 buyers on the market two or three days of the week buying for small packers outside Chicago, 98 to 115 traders and speculators, and 12 to 20 stocker and feeder buyers.

b. Order buyers. The order buyer represents packing plants or others at some distance from the yards and executes their buying orders.

c. Yard traders. Individual buyers who buy for resale at the yards are known as yard traders. They buy principally livestock suitable for further feeding and sort it into groups for resale.

d. Miscellaneous buyers. As the trading facilities are open to all, there are other buyers on the market who are not included in the above groups.

THE LIVESTOCK EXCHANGE

This is an organization of the commission houses doing business on the market. Its functions are to fix the schedule of charges for the selling and buying of livestock, establish and enforce the rules pertaining to trading, and handle the shippers' claims for livestock injuries and losses. There is also a National Livestock Exchange made up of membership from the local units.

TRADERS' LIVESTOCK EXCHANGE

Commission companies act as buying and selling agencies and do not buy livestock on their own account. Those who buy and resell at the market on their own account are yard traders. These traders have their local and national organizations.

OTHER ORGANIZATIONS ON THE CENTRAL MARKET

a. Banks. The transactions on the central markets are for cash or are transfers of credits. Banking facilities are essential for the conduct of the business of the terminal livestock market.

b. Market publications. On large central markets there are publications which disseminate to their readers the news of the market.

c. Governmental organizations. On a large market there are government employees for the market news service, veterinary inspection, and other services.

Corn Belt Farm Dailies

The *Chicago Daily Drovers Journal*, which is the largest of the livestock publishing institutions, was founded in 1873. It, with the following, comprise the membership of the Corn Belt Dailies, the publications of the midwestern livestock industry: *Omaha Daily Journal-Stockman*, *Kansas City Daily Drovers Telegram*, and the *St. Louis Daily Livestock Reporter*.

The *Chicago Daily Drovers Journal* publishes annually a *Yearbook of Figures of the Livestock Trade*, the thirty-ninth issue of which was for 1939. This publication gives data on the marketing of farm products.

Livestock at the Central Markets

At the receiving or chute office the bills of lading for rail shipments are posted for the information of the commission men. The cars of livestock arriving by train are switched to the unloading docks by the stockyards transportation company. Employees of the stockyards receive the way bills, unload the livestock, and deliver it to the pens of the commission company to which it is consigned. In the pens the livestock is fed and watered. The commission man orders the feed which is handled by the stockyard company. A salesman from the commission house offers the livestock to the various buyers. When a sale is made, it is on the basis of the price per hundred pounds live weight.

After the sale the stock is driven to the scale, which is operated by the stockyard company. A ticket is made out at the scale house, which indicates the buyer, seller, and sale price. The weight is stamped on the sale ticket. As the livestock leaves the scale, it becomes the property of the buyer and it is penned in his pens until it is removed for slaughter or reshipment.

The buyer of the livestock makes payment for it to the commission company, which in turn remits to the shipper. The cost of shipping and selling is deducted, and the net returns delivered to the shipper. The deductions from the total returns include the charges for transportation, yardage, feed, insurance, commission, and other items.

Cooperative Cattle Marketing

COOPERATIVE SHIPPING ASSOCIATIONS

The local cooperative shipping associations pool together shipments of livestock for their members and ship them to the livestock market. Very few shipping associations are located in the territory surrounding public stockyard markets, or interior packing plants. The local manager weighs the livestock as it is assembled. In mixed shipment marking for identification is a necessary service which the manager performs in addition to handling the details of shipping. The livestock may be sold through any of the usual channels. These associations perform the same functions as the local buyers. The increased use of trucks has caused less need for pooling of livestock in car lots. Consequently, cooperative shipping associations have decreased in number. Also with the greater dissemination of market news by radio and press, and the improvement of market classing and grading, livestock owners are in closer touch with the market. With greater flexibility in shipping owing to the use of trucks and with the development of more market outlets, producers have become less dependent upon the shipping associations.

COOPERATIVE COMMISSION ASSOCIATIONS

A committee of the American Farm Bureau made a study of livestock marketing, and their report with a plan of action was given in November 1921. Twenty-one terminal cooperative livestock sales agencies were formed in the next four years. These organizations endeavor to return to the members a patronage dividend. They are not usually members of the livestock exchange.

Shrink and Fill in Market Cattle

The loss in weight from the feed lot to the market is known as "shrink." At the yards livestock are fed and watered, which constitutes "fill." The loss in weight or shrinkage is largely from the passing of feces and the urine, and the moisture in the expired air or "Excretory Shrink." Some loss from the body tissues or tissue shrink, also results from metabolic or breaking

down changes. These no doubt begin very soon after the food in the digestive tract ceases to supply nutrient material. It has been estimated that, considering the limit on the time en route, this loss is seldom greater than ten pounds per steer. In shipment the animal is virtually fasting. Energy is needed for the vital processes of the body, and to supply this need there is an actual breakdown of body tissue.

The shrink or loss in weight is expressed as a percentage of the feed lot or home weight. A 1200-pound steer at the point of shipping that has a final sale weight of 1170 pounds has a weight loss of 30 pounds, or a shrink of 2.5 per cent. As previously mentioned, cattle are usually fed and watered before they are sold. The sale weight then represents not the maximum loss in weight in shipping as some has been regained by the fill.

Factors in Cattle Shrinkage

The factors that are related to the shrink in shipment have been studied. Following are the conditions related to shrink.

HOURS IN TRANSIT AND DISTANCE TRAVELED

The limit of the length of shipment of cattle is 28 hours, when they must be fed, watered, and rested. It is common when a long ship is anticipated for the shipper to sign a release which accompanies the way bill, and permits the transportation company to extend the limit to 36 hours.

The longer cattle are en route and the greater the distance traveled, the greater the shrinkage. However, the relation is not directly proportional as the rate of shrink diminishes with the distance.

CONDITIONS DURING THE SHIPPING PERIOD

Extremes in weather influence the amount of shrinkage. The handling in loading, comfort in the car, and the handling en route also affect shrink. Cattle loaded roughly in crowded, uncomfortable cars, and given a rough ride with frequent stops and rough starts, will shrink heavily.

CONDITION OF THE CATTLE WHEN LOADED

In general, there should be no great deviation from normal in feeding or handling of cattle before shipment. Changes in

amount or kind of feed, shrinking or filling before shipment are to be avoided in holding shrinkage to a minimum.

THE NATURE OF THE RATION FED

On some rations cattle will shrink more in shipping than on others. Rations mostly of roughage usually cause cattle to shrink more than concentrated rations.

THE WEIGHT REGAINED AT THE MARKET

If conditions are favorable and livestock are given sufficient time in the yards before they are moved to the scales, the weight recovery will be greater and the net shrinkage relatively low. The fill will vary with the amount of the weight loss up until the time the cattle are unloaded, rested, fed, and watered. With a heavier loss there is usually a greater recovery. It is estimated that it would take at least 48 hours on feed and water for cattle to recover their initial weight.

Shrinkage in Shipment¹

Average estimates of a number of market buyers and salesmen have been summarized by Armour's Livestock Bureau. The shrinkage varies with the weight of the cattle, the degree of finish, distance of shipment, and other factors. Following is a tabulation of the average estimates of shrinkage.

SHRINKAGE OF CATTLE IN SHIPMENT

Pounds per Individual

Class and Weight of Cattle	Truck		Railroad		
	50 mi.	100 mi.	400 mi.	1000 mi.	2000 mi.
Steers					
1200 grain fed	20	30	40	50	
Baby beeves	15	25	30		
750 feeders			50	60	75
1200 grass fed		50	65	75	100
She-stock					
1000 cows	25	50	75	85	100
800 heifers	15	30	45		

¹ Armour Livestock Bureau, *Monthly Letter to Animal Husbandmen*, Vol. 7, No. 9, December 1926, and Vol. 10, No. 5, August 1929.

It will be noted that the largest amount of shrinkage, relatively, occurs on short hauls. Roughage- and grass-fed cattle shrink more heavily than grain-fed cattle. The actual weight loss increases with the length of the shipment.

Cattle Buying and Fills

The gains in weight made by filling, other than water, are largely feed that is in the digestive tract. This is of no particular value to the meat packer on slaughtering; in fact it may be a disadvantage. Since buyers attempt to estimate dressing percentage in purchasing cattle, the tendency is for them to dis-



FIG. 25. Beef steers in the yards. Grand champion load of steers at the 1941 International Livestock Exposition. Shown by Schmidt Bros., Delmar, Iowa.

count for fills in making bids. Heavily filled cattle tend to borrow a value from other cattle inasmuch as cattle buyers check the yields of the cattle purchased and slaughtered. Consequently, if serious errors of estimate are made, the tendency is to lower estimates subsequently. Feeding and watering of cattle to the extent that it arrests restlessness and has a quieting effect may be justified, but beyond that it seems an economic waste.

Government Regulation of Cattle Marketing

In 1921 by an Act of Congress the Packers and Stockyards Administration¹ was set up to ensure and enforce fair trade practices and free competition in livestock trading or terminal markets. This jurisdiction applies to stockyards with an area of 20,000 square feet exclusive of alley ways. In application it affects packers, stockyard companies, and all marketing agencies. Discriminative practices, such as apportionment of supply so as to create a monopoly, manipulation or controlling prices, combination or agreement for any kind of apportionment by meat packers, are violations. Stockyard companies and agencies such as commission companies are required to furnish reasonable services without discrimination at a posted schedule of rates and charges.

The Secretary of Agriculture is given the power under the act to conduct hearings on violations of the act and to prescribe reasonable charges, rules, etc., when necessary. The Secretary may inflict fines for violations of the rules and regulations. However, the offending organization may have recourse to the courts.

Government Reports from Cattle and Other Livestock Markets

The market news is gathered and disseminated by a bureau of the United States Department of Agriculture. The news reaches interested persons by letter, press, wire, and radio, and covers a wide number of commodities. Livestock offices are located in several midwestern terminal markets, and there are also regional offices for pooling the statistics. This was formerly a function of the Bureau of Agricultural Economics, but on July 1, 1939, it was included under the Agricultural Marketing Service.

Agricultural Marketing Service²

The Agricultural Marketing Service is a service and regulatory agency concerned with the various phases of marketing farm products. Its activities fall within five broad fields: (1) the

¹ Packers and Stockyards Act, 1921. General Rules and Regulations of the Secretary of Agriculture, U.S.D.A., B.A.I. Order 323, 1930.

² *For Your Information*, Agri. Marketing Service, U.S.D.A., December 1939

collection and dissemination of crop and livestock production and other agricultural statistics; (2) the gathering and reporting of current market information from terminal markets, shipping points, and producing sections; (3) standardization and inspection to provide a uniform system for measuring gradations in quality of farm and food products, and a common language in merchandising these products; (4) research and demonstration in standardization, grading, preparation for market, handling, and other related phases of marketing; and (5) the administration of "rules of fair play" in the merchandising of farm commodities.

Many reports are issued by the Agricultural Marketing Service dealing with market news on livestock, meats, and wool and with livestock numbers and production estimates. These reports may be procured without charge by addressing this organization, United States Department of Agriculture, Washington, D.C.

Transportation of Cattle by Trucks

In market receipts a distinction is made between rail and nonrail shipments. The latter group is referred to as the "drive-in" receipts because formerly they were driven into the yards. Now these are mostly truck shipments. During 1939 at the 17 principal markets 64.4 per cent of the calves and 62.3 per cent of the cattle were classified as "drive-ins." More hogs were trucked in than cattle and calves, while fewer sheep and lambs reached the markets by truck.

The markets vary in the proportion that is shipped by means other than rail. Of the total receipts at the 17 markets, Denver had the smallest percentage of "drive-in" receipts (16.9 per cent) while Sioux Falls had the largest (96.8 per cent). Rail shipments predominate for long shipments, whereas truck shipment is favored for short hauls.

Truck shipments have increased greatly in recent years. The first shipment of livestock by motor truck to a public market was made in 1911, and by 1935 the truck was used for more than half of the livestock delivered at the livestock markets. Improved roads have given the shipper access to greater diversity of markets and also have made convenient the shipping

of smaller droves. The motor truck moves livestock from the farm to the slaughtering plant or stockyard conveniently and quickly, and as a consequence with but little weight loss or shrink. Motor transportation rates have declined in the past decade while railroad rates have remained practically the same.

Number of Cattle in a Railroad Car

Railroad cars in which livestock are shipped to market are usually either 36 or 40 feet in length. The size of the car and the size of cattle determine the number which can be loaded in a car. For comfort in shipping the car should be loaded heavy enough so that the animals stand fairly close together; however, crowding is to be avoided. Tabulated below is the average number of head of different weights which can be loaded in a car.

CATTLE PER RAILROAD CAR¹

Car Size	Average Live Weight, pounds											
	300	400	500	600	700	800	900	1000	1100	1200	1300	1400
36-ft. car	60	50	42	37	33	30	27	25	23	22	21	19
40-ft. car	67	56	46	40	37	33	30	27	25	23	22	21

Injury and Death Losses in Marketing Cattle

Damage to the extent that bruise marks are noted on the carcass is not at all uncommon. A survey in which 50 packing plants cooperated showed that 20.7 per cent were bruised. This survey also showed a small percentage crippled and dead. The loss through damage of livestock en route to market has been estimated at over 12 million dollars a year in the United States. The bruise marks on the carcass cannot be determined with accuracy at the time of sale. The processor, therefore, discounts all purchases enough to make allowance for a certain loss from bruises. Badly bruised cattle will have cuts and bumps upon them, but the extent of the damage can be determined only by the examination of the carcass. Conse-

¹ Swift & Co., *Bull.* 20, May, 1941.

quently, greater damage is anticipated where there is evidence of bruising. Horned cattle also sell at a discount because of damage which the horns invariably produce on the carcasses of other cattle in the lot. A 1939 survey at the Union Stockyards at Chicago indicated that 86 per cent of the cattle from the range states and 73 per cent of the native cattle were without horns. Crippled animals are purchased at lower prices than animals that are sound. Dead animals are sold on the basis of tankage prices.

The livestock producer is the heaviest loser from damage to livestock being marketed. Even though the individual shipper be indemnified for the loss in the form of a claim payment from the shipping railroad or truck company, the services of these shipping agencies are set at a sufficiently high rate to cover losses.

Factors that Influence Shipping Losses

The various conditions which have been found to be related to shipping losses in livestock may be listed as follows:

1. The type of transportation used.
2. The species or kind of livestock shipped.
3. The class within a kind or species.
4. The distance the livestock is transported.
5. The season of the year.
6. The carefulness of the trucker.

These factors have been investigated by the Minnesota Agricultural Experiment Station.¹

There are no doubt many other factors responsible for damage in shipping. Livestock fed on adequate rations and normally developed are better able to withstand shipping damage and losses than poorly fed, underdeveloped stock. Injuries during loading and unloading are also a factor.

The type of transportation (rail and truck) and the kind of livestock and their relationship to losses are discussed further in the following paragraphs.

¹ A. A. Dowell and R. J. Eggert, "Death and Crippling in Livestock Marketing," *Bull.* 342, Minn. Agr. Exp. Sta., May 1939.

Extent of Crippling and Death Loss in Market Cattle

The extent of crippling and death losses at some of the principal midwest livestock markets has been surveyed by the National Livestock Loss Prevention Board. This includes losses appraised at the time of unloading and does not include damage done in the stockyard.

The survey was for the period 1935-1939, inclusive, and covered the livestock dead and crippled on arrival by railroad and truck at Kansas City, St. Joseph, Omaha, Sioux City, and St. Paul. Following is a summary of their findings:

PERCENTAGE OF DEAD AND CRIPPLED CATTLE AND CALVES
ON ARRIVAL BY RAILROAD AND TRUCK AT FIVE
MIDWEST CENTRAL MARKETS
Average for Five Years, 1935-1939¹

<i>Livestock</i>	<i>Per cent Dead</i>		<i>Per cent Crippled</i>	
	<i>Rail</i>	<i>Truck</i>	<i>Rail</i>	<i>Truck</i>
Cattle	0.018	0.040	0.039	0.128
Calves	0.138	0.152	0.098	0.098

It will be noted that calves are more subject to shipping losses than cattle. With cattle the death loss in truck shipment is more than two times that in rail shipments and the crippled loss is more than three times greater. Calves fail to show any marked disparity in losses from the two methods of transportation.

Compared with the other kinds of livestock the death loss is the greatest in sheep, the least in cattle, and hogs are lower in this loss than calves. In the amount of crippling, swine rank highest, with calves, cattle, and sheep following in the order named.

Considering transportation by truck as compared with rail shipments, the calves show less proportionate death loss and crippling for trucking than cattle. There is greater crippling and death loss in shipping calves, but this loss is about the same

¹ H. R. Smith, "Progress in Reducing Livestock Diseases and Waste in Marketing," *National Livestock Loss Prevention Board Report*, 1939.

for truck as it is for rail shipment. Cattle, on the other hand, show much more damage in truck than in rail shipments. Sheep show even a greater susceptibility to truck damage, while hogs are more like calves in relative losses in truck and rail shipping.

National Livestock Loss Prevention Board

This organization, through its general manager at the Union Stockyards, Chicago, and four regional managers on the markets at Sioux City, Kansas City, South St. Paul, and Omaha, is working toward the reduction of animal diseases and losses in marketing livestock. Its object is to initiate and encourage education and research, to correlate and coordinate present activities and information, to secure new data, to disseminate correct information, and to promote practical and proper methods of reducing and eliminating preventable livestock losses during the marketing process. Apparently this campaign has been successful, as there seems to be an irregular trend downward in shipping losses.

Precautions for Preventing Losses in Marketing Livestock

By careful attention to the following details the losses in marketing of livestock from death and crippling may be reduced. The following is suggested by the National Loss Prevention Board for the proper care in handling livestock in marketing.¹

1. See that animals are not heavily fed just prior to loading.
2. Use good loading chutes at the farm.
3. Provide good footing with sand or fine gravel for bedding.
4. Cover sand with straw for better appearance when unloaded, but use no straw for hogs in hot weather.
5. Before loading hogs in hot weather, wet the sand bedding.
6. Provide covers for trucks, to protect against the sun in hot weather and against severe cold in winter.
7. Always use partitions in mixed shipments, to separate small from large animals.
8. See that there are no protruding nails, bolts, or any other sharp objects in truck or car.

¹ H. R. Smith, "The Reduction of Losses in Marketing Livestock," *National Livestock Loss Prevention Board Report*, 1937.

9. Load and unload carefully, to avoid jamming.
10. Don't overcrowd in trucks or cars.
11. Tie all bulls.
12. Use canvas slappers instead of clubs or whips.
13. Dehorn cattle before they go into the feed lots.
14. Slow down on sharp curves, and avoid sudden stops.
15. In unloading trucks, do not drop calves, sheep, or hogs from upper to lower deck; provide cleated inclines.
16. Never lift sheep by the wool.

National Livestock and Meat Board

The purpose of this organization is to increase the consumption of meat and meat products. Livestock sold for slaughter are assessed at the rate of 25 cents per carload or, when in less than carload lots, at the rate of $\frac{1}{3}$ cent for each calf or hog, $\frac{1}{5}$ cent for each lamb, and 1 cent for each head of cattle until the contribution reaches 25 cents. This is deducted from the seller returns, but if he objects no charge is made on his consignment. The packing plants purchasing the livestock contribute a like amount.

Chapter 6

MARKET CLASSIFICATION OF CATTLE AND CATTLE PRICES

MARKET CLASSES OF CATTLE

A trip to a livestock market on any marketing day will serve to emphasize the wide range of cattle offered for sale. The quoted prices paid for the various kinds of cattle may range over \$10.00 per hundred weight from the lowest selling canner cow to the top selling finished beef steer. The variation is due in the main to the differences that would be manifest in the carcass, affecting its value and also the yield or dressing percentage.

Those engaged in producing, distributing, marketing, and processing livestock have need for a common classification system for market animals, and as a convenience there has grown with the expansion of the livestock markets a system of classing and grading livestock. In 1902 Herbert W. Mumford prepared *Bulletin 78* of the University of Illinois on "Market Classes and Grades of Cattle with Suggestions for Interpreting Market Quotations." In this publication an attempt was made to standardize the existing market classes and grades. Market reporting service was started on the Chicago Livestock Market by the Bureau of Markets in 1918, and Mumford's suggestions were used as a tentative basis for formulating a classification of standard market classes and grades. From time to time this classification has been revised and altered to incorporate the suggestions of various agencies on the central markets. Classifications are not the same on all markets, and all agencies on any one market do not use the same terms for indicating various livestock market groups. Much progress has been made in the standardization of terms and reports, and livestock market reports, such as from the market news service of the federal government and livestock papers, have greater meaning than in the past.

Principal Uses for Market Cattle

There are three principal uses for market cattle. The major portion of the cattle receipts are slaughtered for beef, some are sold to go back into the country for further feeding (feeders and stockers), and a few are sold to go into dairy herds. On most markets the latter group is relatively insignificant. The central market has never developed into sizable markets for cattle of dairy breeding to be sold into dairy herds. Those sold on the central markets for dairy production are usually further divided into springers, milkers, and stockers. The cattle in the feeder and stocker division and their market classification will be discussed in Chapter 7. Included in this chapter will be the market classifying and grading of slaughter cattle and a discussion of prices of such cattle. Slaughter cattle are acceptable to the meat trade on foot and will yield meat that is wholesome and suitable for human food, barring condemnations. As cattle are the source of beef, the minimum age is about six months, which is the borderline with veal.

Uses of Market Grading Systems to the Producer

The livestock grower is confronted continually with the problem of what to raise, where, and when to sell. These problems cannot be neglected if livestock raising is to be successful. With market reports available which he can interpret the livestock raiser may know what kind, class, grade, and weight is in greatest demand in proportion to its supply. He can likewise determine where his livestock should be sold to bring the greatest net returns. As seasonal market variations are available based upon the averages of previous years, the grower may plan his production and marketing accordingly. Outlook reports are more meaningful when the producer understands the commonly used terms of the market.

Purposes of Classifying and Grading Livestock

Livestock are sorted into uniform lots to facilitate trading. Groups are made up that have about the same value. The extremes are eliminated so that the entire lot conforms to the specifications for the group. With the group uniform in characteristics it is then possible to determine the exact market

value and report a market transaction in precise terms. A quotation such as "choice to prime yearling beef steers, 1100 pounds, \$12.00," is subject to rather accurate interpretation among all who handle market cattle.

Classifying and Grading Livestock

Formerly the market class was defined as a commercial use for which livestock are adapted and sold. A market grade was also defined as including those within a class which had about the same value per hundred pounds.

Market classes are the large divisions on the market, but their use does not coincide with commercial uses and some confusion exists between the use of terms "class" and "subclass."

Classifying and grading are essentially for the same purpose. Successively cattle are divided and redivided until finally lots of rather narrow variation in essential characters result. The final and most important division is into the market grade. A market grade comprises a group of animals on the livestock market which have a narrow range of variation of essential characteristics and usually sell within a comparatively narrow price range. When a lot or group is sold that is not within one grade they may be indicated by the two grade terms; for example, good to choice. When a wider range is included in one sale lot they are designated as mixed grade.

When used, market class usually refers to the groups differing from one another in sex condition and the development of the secondary sex characters. We have, therefore, these classes in cattle: steers, heifers, cows, bulls, and stags.

Standard Market Classes and Grades

Although the markets are not all the same in their classifications, the standard classification is becoming more widely used. Through the wider sale of graded beef by the meat retailers there has come a greater need of a uniform classification of slaughter cattle. There still exists considerable disparity between markets, especially between corn belt markets and those elsewhere. The characters that are related to value are reasonably stable and can be measured with a fair degree of accuracy.

Factors That Determine Market Division of Livestock

The attributes that are related to the commercial value of market livestock are: sex, condition, age, weight, form, quality, breeding, and flesh condition. In slaughter cattle particular attention is given to all these considerations. The class or large division is dependent upon sex, use, age, and weight, while the grade is dependent upon form, finish, and quality. Within any group of beef carcasses the main features upon which merit is evaluated are quality, form, and finish.

Following is a tabulation of the market classes and grades which may be on the market and this is followed by a brief description of each group.

MARKET CLASSES AND GRADES OF CATTLE

	<i>Basis for Grouping</i>				
	<i>Sex Classes</i>	<i>Age</i>	<i>Use Selection</i>	<i>Weight Divisions</i>	<i>Grades</i>
Divisions in each group	Steers Heifers Cows Bulls Stags	Veal calves Calves Yearlings Two year olds and older	Slaughter cattle Feeding cattle 1. Feeders 2. Stockers Dairy cattle 1. Springers 2. Milkers 3. Stockers	Heavy Medium Light Mixed	Prime or Fancy Selected Choice Good Medium Common Cutter Canner

Market Classes

SEX CLASSES OF CATTLE

At present the sex classes are the market classes. This is also referred to as the sex condition as it involves also groups that have been unsexed. Each of these groups has rather definite characteristics which are easily distinguishable, and these features are definitely related to the commercial value of the carcass. These conditions are used to indicate the sexes, male and female, and the unsexed individuals. The consumer of beef is not concerned with the sex conditions of the live animal from which the beef has come. Little does he care whether it is from a male or

female or if it has been unsexed or at what age the castration was performed. However, the consumer is definitely critical of the properties of meat which affect its eating qualities. Sex condition is highly related to palatability of meats as it affects the quality, finish, and conformation of the carcass.

Cattle are therefore divided into five classes: steers, heifers, cows, bulls, and stags.

STEERS. A steer is a male bovine which was castrated before his secondary sex characters had developed, that is, before the individual reached sexual maturity. Calves are castrated when a few weeks old or any time up to four and five months of age. It is usually suggested that it be done when the calves are four to ten weeks old. Castration causes a different development of the form and the beef is of higher quality because of superior texture, tenderness, color, and flavor. Steers are also more tractable in feed lots than bulls.

HEIFERS. A heifer is a young female bovine that has not had a calf or has not reached the stage of advanced pregnancy. Spayed or unsexed heifers are not greatly different than unaltered heifers, consequently are classed in the same group.

COWS. Classified as cows are female bovines that have produced calves or have reached a stage of advanced pregnancy.

BULLS. A bull is an uncastrated male bovine that has reached sexual maturity. In young calves no attention is paid to the presence of the testicles as they do not affect the carcass materially until sexual maturity is approached.

STAG. A male that has been castrated after reaching sexual maturity and in which the secondary sexual characters have developed.

AGE GROUPS

Because of carcass differences related to differences in the age of slaughter cattle, we have groups which include individuals of approximately the same age. Calves, for example, yield meat of distinctive character and quality. Within this group there is the division into calves and veal calves. When under three months of age a calf will yield a carcass that is classed as veal. Calf carcasses are from cattle younger than yearlings and older than veal calves. They have passed the vealer stage, but they

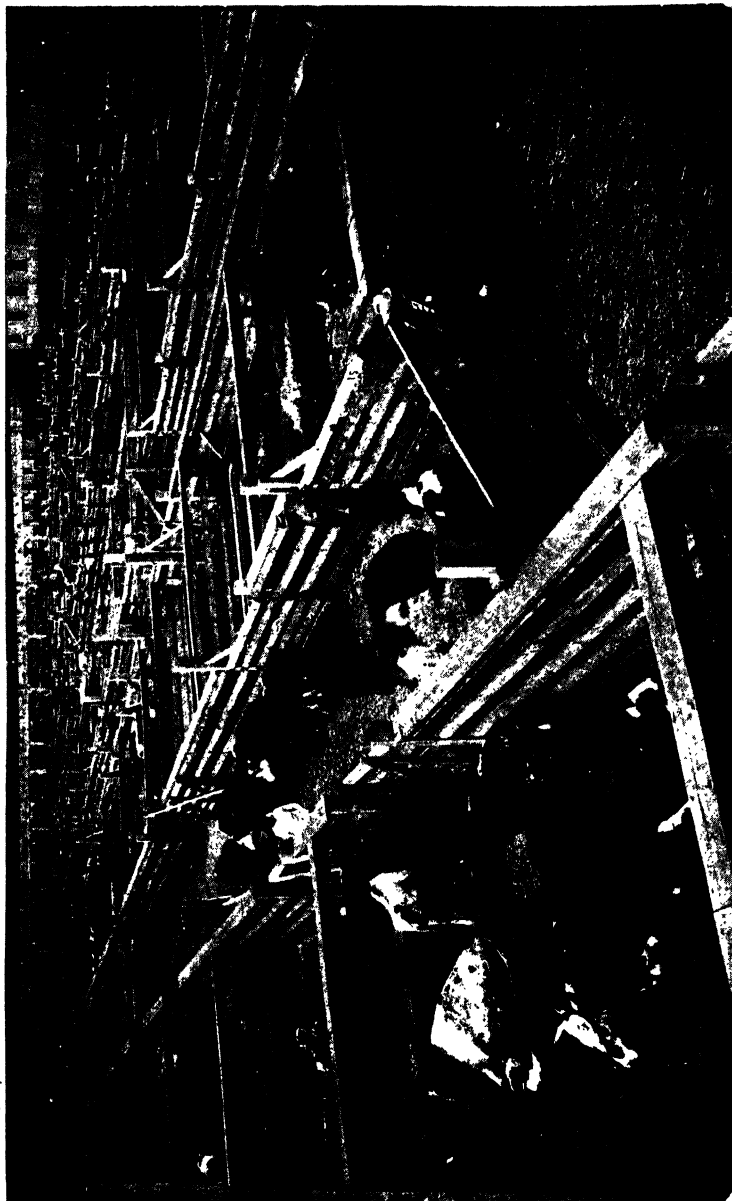


FIG. 26. Slaughter cattle in the Union Stockyards, Chicago. Note the arrangement of the lots, alleys, and gates. (Swift and Co.)

have not acquired sufficient maturity to be classed as cattle. A vealer has been mainly milk fed while a calf has been fed for a considerable time in part or entirely on feeds other than milk.

Cattle are divided into two groups by age. Yearlings or those that are between one and two years of age constitute the younger class. All older cattle, that is, those over two years of age, are commonly grouped together as two years old and over.

AGE CLASSIFICATION OF SLAUGHTER CATTLE

The total number of cattle slaughtered annually in the United States in recent years has been about 25 million head. In the breakup into calves and cattle older than calves about 31 per cent were in the former and 69 per cent in the latter group. The distinction between the two groups is not uniform on the different markets. Usually calves are under 400 pounds in weight, but the cattle are not weighed as they arrive at the market and the classification is based upon the judgment of stockyard company employees when it is not indicated on the bill of lading.

USE SELECTION

Often the use to which cattle are put is designated as the market class. There are three main commercial uses: (1) slaughter, (2) feeding, (3) milking heifers and cows. Any of the cattle or calves offered on the market can be in the slaughter class with the possible exception of those for dairy purposes. Cattle going immediately to meat processors are termed slaughter cattle, while feeding cattle are those which are sold for further feeding. These including beef stock females and feeding cattle are discussed under Feeder and Stocker Cattle. The demand for feeding cattle influences the division made on a market between these two classes, for many cattle and calves on the market can go into either group. These are often referred to as two-way cattle.¹ The cattle and calves having conformation and other qualities particularly suitable for feeding bring a higher price when sold as feeders than when disposed of as slaughter cattle.

¹ Two way with reference to market livestock means two uses. Cattle suitable for slaughter or feeding are sold to the group that will pay more for them.

Very few of the milking heifers and cows reach the central markets. These may be springers, milkers, and stockers, and to qualify they must show dairy or milking qualities. A milker is a cow giving milk, while springers are pregnant females due to calve shortly and possessing dairy characteristics. Heifers of dairy breeding sold for dairy production are called dairy stock heifers.

WEIGHT DIVISIONS

In the breakup of market cattle and calves by weight groups it is common to have three classes: lightweight, medium-weight, and heavyweight. When lots of cattle of a kind are of several weight divisions, the lot is designated as "mixed weight."

GRADES

The final step in the classifying process is grading. A grade includes all within a kind that sell for about the same price per pound. The grade is determined largely from the quality, form, and finish. In cattle grading the terms, ranked in order of merit, are: prime, choice, good, medium, and common. However, all groups are not graded the same. For example, there are prime steers and heifers, but these grades are not used for cows and bulls. Also in stocker and feeder classes the grade prime is not used because prime commonly refers to high finish which is not typical of feeder cattle. In lieu of prime, fancy, or fancy selected, is employed for feeders. As the variation within a market group of cattle is not the same, the number of grades for a class, subclass, age, or weight is variable.

Schedule of Market Classes and Grades for Slaughter Cattle

Following is an adaptation of the classification or schedules for slaughter cattle and calves from the publications of the United States Department of Agriculture on market classes and grades.¹

¹ C. E. Gibbons, "Market Classes and Grades of Livestock," *Bull.* 1360, U.S.D.A., June 1926.

Don J. Slater, "Market Classes and Grades of Cattle," *Bull.* 1464, U.S.D.A., August 1940.

Don J. Slater and M. T. Foster, "Market Classes and Grades of Calves and Vealers," *Circ.* 28, U.S.D.A., November 1936.

<i>Sex Classes</i>	<i>Divisions</i>			
	<i>Age</i>	<i>Weight Class</i>	<i>Pounds</i>	<i>Commonly Used Grade</i>
Steers	Yearling	Light Medium Heavy	800 down 800 to 950 950 up	Prime, choice, good, medium, common, cutter
	Two years old and over	Light Medium Heavy	1100 down 1100-1300 1300 up	Prime, choice, good, medium, common, cutter
Heifers	Yearling	Light Medium Heavy	800 down 800-900 900 up	Prime, choice, good, medium, common, cutter, canner
	Two years old and over	Light Medium Heavy	900 down 900-1050 1050 up	Prime, choice, good, medium, common, cutter, canner
Cows	All ages	All weights		Choice, good, medium, com- mon, cutter, canner
Bulls	Yearling	All weights		Choice, good
	Two years old and over	Light Medium Heavy	1300 down 1300-1500 1500 up	Choice, good, medium, com- mon, cutter
Stags	All ages	All weights		

The above classification provides a group designation for nearly all kinds of slaughter cattle which come to the market. In actual practice not all of these divisions are found even in a large cattle market on a day of heavy receipts. Also this classification is not applied the same on all markets.

This schedule provides a place for every group into which buyers and sellers may wish to sort cattle. On smaller markets many of the divisions are lumped together. Not all of the grades are used in the various divisions. Those listed are the common ones which may possibly be used. The term "canner" indicates a low grade, but only a small amount of the meat from this kind is actually canned. In grade canners are inferior to cutters which are the source of some wholesale cuts of carcass beef. Boneless beef may come from cutters, canners or the better grade.

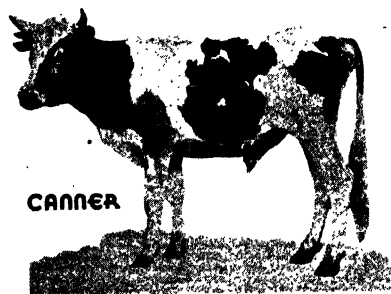
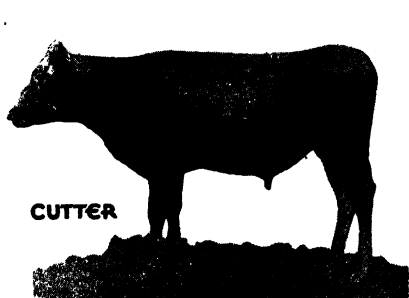
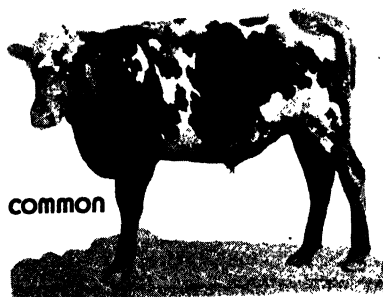
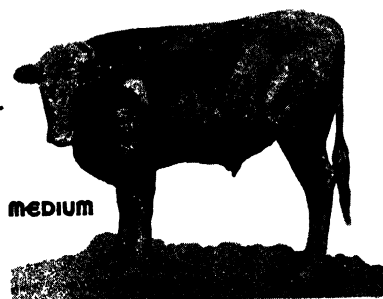
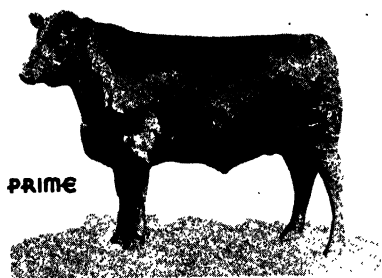


FIG. 27. United States grades of slaughter steers. (U.S.D.A., Agricultural Marketing Service.)

Characteristics of Important Market Classes and Grades of Cattle

For a detailed description of the typical individual in the various grades, reference should be made to United States Department of Agriculture publications listed on page 82.

BEEF STEERS

Beef Steers are the top selling slaughter cattle on the market, and the top grade is prime. (See Figure 27.) Usually the two top grades, prime and choice, are joined because very few of the prime cattle are produced.

Following is a tabulation of grade and slaughter weights of beef steers from the corn belt marketed at Chicago for a ten-year period.

**BEEF STEERS FROM THE CORN BELT SOLD AT CHICAGO MARKET
PERCENTAGE OF TOTAL BY GRADES AND WEIGHTS BY GRADES**

Ten Years, 1930-1939

<i>Grades of Beef Steers</i>	<i>Per Cent of Total Receipts</i>	<i>Average Weight, Pounds</i>
Prime and choice	20.3	1144
Good	45.1	1071
Medium	26.2	972
Common	8.4	872
All grades	100.0	1045

It will be noted that prime and choice graded steers make up about one-fifth of the steer receipts from the corn belt at the Chicago market. It has been estimated that less than 1 per cent of the total receipts of beef steers are graded prime. Steers graded good make up nearly one-half of the total, while medium steers account for about one-fourth of the entire beef steer receipts. This indicates a higher percentage of better grades than a survey of beef carcass grades made in 1918 to 1920. Also there is a decided trend toward higher grades in the slaughter steers from 1922 to 1939.¹

A comparison of the grade distribution for the two years is as follows:

¹ The improvement in market cattle has been brought about by the improvement in quality by breeding and also the use of better feeding methods.

<i>Grade Beef Steers from Corn Belt</i>	<i>Percentage of Total</i>	
	<i>1922</i>	<i>1939</i>
Choice and prime	13.1	28.4
Good	32.8	46.6
Medium	41.3	21.4
Common	12.8	3.6

Better grades have heavier weights, as would be expected, indicating greater finish. There is about a 100-pound spread between the common, medium, and good classes, while the prime and choice group outweigh good steers by more than 70 pounds.

In conformation, form, and quality prime steers closely approximate the requirements of an ideal steer. Lower grades lack in these qualities and consequently yield carcasses which sell at lower prices. They likewise have a lower yield or dressing percentage than prime steers. Prime steers are of first rank in form, quality, fleshing, and dressing percentage. Such steers are of beef breeding.

BABY BEEF

On the market baby beeves are in the yearling class. The carcasses to be designated as baby beef must be from good, choice, or prime animals of the beef breeds (steer or heifer) from 7 to 18 months of age and weighing 600 to 1200 pounds on foot. Baby beef may be divided into: (1) fat calves — 7 to 9 months old, weight 600 to 700 pounds, (2) regular or standard baby beeves — 12 to 18 months old, weight 700 to 1000 pounds, (3) heavier yearlings — 18 to 24 months old, and over, 1000 pounds in weight. "Super baby beef" is sometimes used to refer to well-finished good-quality calves ready for market at 650 to 850 pounds.

HEIFERS

This group is nearly equal to beef steers in value when equal in conformation, finish, and quality. A few heifers will often pass in a load of steers with no discount in price. In heavier weights the disparity of the price widens because heavy heifers become more like cows in conformation, and often older, heavy heifers are with calf. Comparable grades of heifers sell for nearly \$1.00 per hundred pounds less than beef steers.

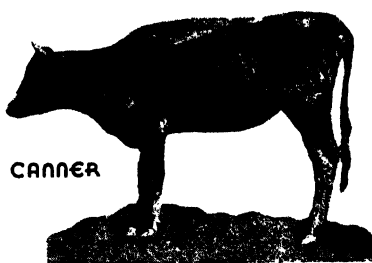
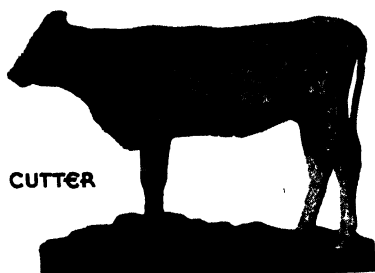
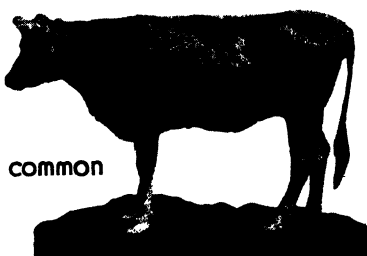
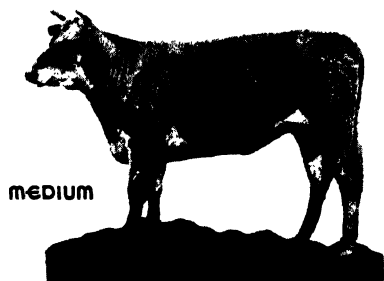
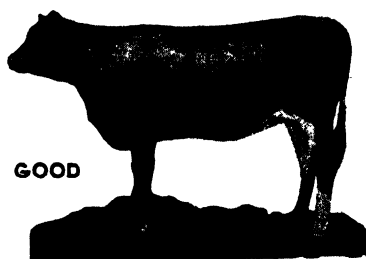
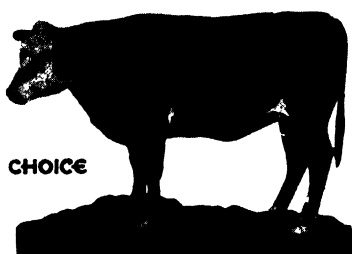


FIG. 28. United States grades of slaughter heifers. (U.S.D.A., Agricultural Marketing Service.)

In appearance the best slaughter heifers approach the ideal beef type and are of beef breeding. See Figure 28. Lower grade heifers lack in form, quality, and finish and the poor grades are of dairy breeding. Many comparisons have been made of steer and heifer beef, and these studies apparently warrant the following conclusions:

When steers and heifers of comparable age and breeding are fed and managed the same, heifers finished at a young age for slaughter have the following characteristics:

1. They are higher in finish, and the fat is more localized.
2. They are higher in dressing percentage if they are not with calf.
3. In the market grade both on foot and in the carcass there is no consistent difference as compared to steers.
4. In the palatability of the beef there is no distinct difference.
5. To produce beef comparable with steers, heifers must be of beef breeding, finished rapidly, sold at light weights.

Heavy heifers become rough and patchy and are often in calf. Steer carcasses are heavier in the rounds and the ribs than the heifer carcasses.

PREGNANCY IN HEIFERS. In a study of pregnancy and its effect upon the yearling heifers at the Illinois Agricultural Experiment Station¹ it was found that the pregnant heifers were less active, had more digestive activity, and were inhibited in growth. Apparently the rate of gain was not affected. Apparent slaughter merit, that is, on foot appraisal of the slaughter value, was lower for the pregnant heifer than open. The carcasses of the heifers pregnant five months were fatter and more desirable in finish. In composition the pregnant heifers had 5 per cent more fat, 3.5 per cent less lean, and 1.5 per cent less bone in the carcass. No apparent change was made by pregnancy in the weight of the wholesale cuts or the color and firmness of the fat.

Contrary to common opinion, in this one test the in-calf heifers yielded as large a proportion of carcass as the open heifers. Although the pregnant uterus weighed on the average 30 pounds at the time of slaughtering, this was overcome by the

¹ R. R. Snapp, *Beef Production*, Chap. 18, Wiley, New York, 1939.

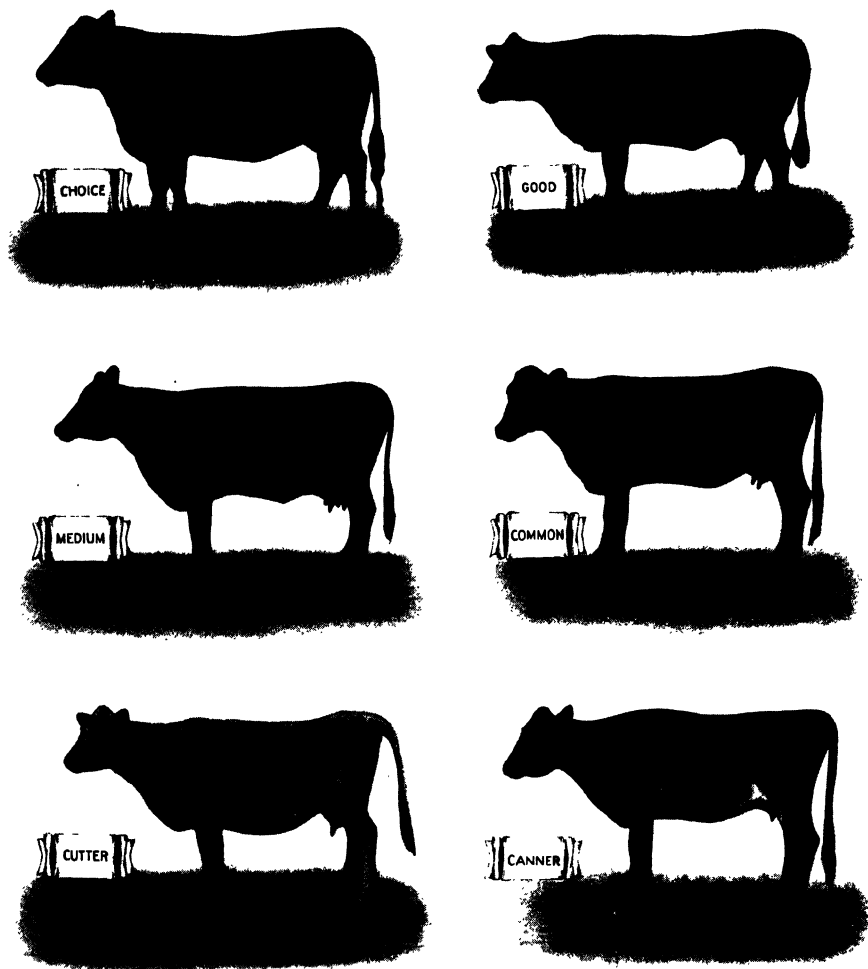


FIG. 29. United States grades of slaughter cows. (U.S.D.A., Agricultural Marketing Service.)

lighter hide and bone, the greater amount of fat on the carcass, and a smaller fill. The pregnancy up to five months on the yearling heifers appeared not to affect adversely productive capacity or beef value.

The breeding of heifers three or four months prior to marketing seems justified in the light of these findings, but marketing prior to marked change in appearance is desirable. Heifers heavy in calf are heavy in the middle and usually patchy.

COWS

Good grade cows are of beef breeding, and rather young cows which approach heifers in form are termed "heiferettes" on some markets. See Figure 29. Comparable grades of cows sell for nearly \$3.00 less per hundred pounds than heifers. Carcass differences account for most of this price difference, but heifers also yield higher than cows.

BULLS AND STAGS

The better grades of bulls, choice and good, are often termed "beef" or "butcher" bulls to distinguish them from medium and common bulls, which are often called "bologna" bulls.

BUTCHER STOCK

On many markets this term is used to designate slaughter heifers, cows, bulls, and stags suitable to be sold in the carcass as block beef. Such beef is acceptable to the retailer in halves or quarters. This group excludes cutters, low cutters, or canners which are not usable for block beef.

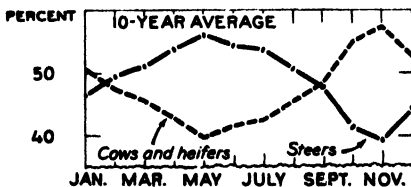


FIG. 30. Distribution of steers, cows, and heifers slaughtered, by months. Steer slaughter is low in the fall because many are sold as feeders. (U.S.D.A., Bur. of Agri. Economics.)

Seasonal Variation in Sexes Marketed

Cows and heifers are of lower weight when marketed than steers. The seasonal variation in the market weights of cattle is therefore related to the proportion of cows and heifers in the cattle marketed. The months of April, May, June, and July

are the lowest in percentage of cows and heifers in the federal inspected slaughter. The greatest liquidation of the stock occurs in the months of October, November, December, and January, which have the highest percentage of cows and heifers in the supply of cattle slaughtered. For a ten-year period the average percentage of cows and heifers in the slaughter ranged from 41 per cent in May to a high of nearly 60 per cent in November. (See Figure 30.)

Yearly Variation in Sexes Marketed

The cow and the heifer slaughter fluctuates more widely over a period of years than steer slaughter. If feed crops and pasture conditions are favorable, breeding herds are built up and the proportion of cows and heifers slaughtered is below average. Steer slaughter is reduced when feed supplies for cattle finishing are short.

Schedule of Market Classes and Grades for Slaughter Calves

Slaughter calves are less than 12 months and more than 3 months of age. They have been fed on feeds in addition to milk and have passed the veal stage. Many calves of this kind are sold as feeders, yet a considerable number are sold for immediate slaughter. Calves of this kind are most numerous on markets nearest the range country, especially the southwestern part. The calf carcass is used as beef, and produces a relatively large proportion of valuable by-products such as the liver, tongue, heart, brains, sweetbreads, and fat, as well as the hide.

Following is a schedule for slaughter calves.

<i>Classes</i>	<i>Weight Divisions</i>	<i>Commonly Used Grades</i>
Steers	Lightweight, 200 pounds down	Prime, choice, good
Heifers	Medium-weight, 200-300 pounds	Medium, plain, cull
Bulls	Heavyweight, 300 pounds up	

In slaughter calves there are three classes based upon sex condition as the sexual characters become more manifest as the calf approaches 12 months of age. Similar weight divisions as grades are used for the different classes, that is, for steers, heifers, and bulls.

Schedule of Market Classes and Grades for Veal Calves

Veal calves are usually under three months of age. The age range is from three weeks to three months, and the weight range is from 100 to 200 pounds. Relatively few are beyond these limits of age and weight. The condemnation for immaturity was under 1 per cent for the year of 1939. It is required that calves should be at least 21 days of age for slaughter. Under-age veal calves are called "deacons" or "bob veal." Veal calves are most numerous on markets near the dairying sections.

Following is the schedule for veal calves.

<i>Class</i>	<i>Weight Division</i>	<i>Commonly Used Grade</i>
Males and females	Lightweight, 110 pounds down	Prime, choice, good, medium, plain, culls
	Medium-weight, 110-180 pounds	
	Heavyweight, 180 pounds up	

Little attention is paid to sex condition in veal calves because it is not related very definitely to quality, condition, or form of the carcass. Weight is the most important factor in determining the market price of veal calves. This group varies but little in weight and essential characteristics. Like slaughter calves the by-products constitute an important item in their returns to meat packers.

CATTLE PRICES

Cattle prices are variable because the volume of production is not adjusted to the demand for beef and other cattle products. Meat is a perishable product, and the supply, which is not controllable, must be moved into consumption in a comparatively short period of time. Storage by refrigeration (freezing) may divert from immediate consumption some of the supply as would also such processing as canning or curing. However, it must eventually be used for food, and storing adds to the cost.

The carcass is the most valuable of the products from cattle slaughter. This is either sold on the domestic market or exported. Since our exports of beef are practically nil, our domestic market takes all of the available supply. Some beef (especially canned from South America) is imported. The value of the carcass depends upon the demand and also the supply.

With liberal supplies of meat, or low purchasing power of the consumer, low cattle prices prevail.

Cattle Prices and Cattle Numbers

The prices of beef cattle tend to move in cycles which are related to cattle production and to such episodic influences as droughts which have affected numbers and hence prices. The cattle population moves in cycles which result from the cattle raiser's response to cattle prices. Good prices cause expansion and poor prices liquidation. The numbers follow the price, consequently there is a lag of about four years, the length of time necessary for increased production to be reflected in marketing. The wavelike variations in numbers are about 15 years long, with the increasing period seven years and the downswing eight. Cattle numbers have also shown a rather constant expansion as well, which has been coincident with the increase of our human population. Expansion has been largely in the numbers of dairy cattle. As our population has slowed down in its rate of increase, the same will probably happen to cattle.

Cattle prices are high relatively when numbers are low and vice versa, and there is a marked tendency for prices to follow numbers with a lag in time comparable to the time that it takes to increase or decrease production.

Cattle Prices by Classes and Grades

There is considerable spread in the cattle market from the lowest selling canner cow to the highest selling beef steer. As would be expected, this spread is greater when the top price is high. A market is found for all cattle offered for sale; the demand for beef is therefore a striated affair; all parts are not always in the same relationship. With an oversupply of finished steers, the price for them would be depressed, even though, for example, medium and common or bologna bulls may be short in supply and consequently relatively high in price. Such a situation also exists with the group beef steers; that is, the spread between grades is not constant but may be seasonal.

Following is a tabulation of slaughter cattle by grade based on a ten-year period and determined from yearly averages. This comparison will serve to show the spread between usual

class and grade prices,' but as there is considerable year-to-year difference, the average may not be typical of a single year.

CATTLE PRICES BY CLASSES AND GRADES, CHICAGO MARKET
Ten-Year Average, 1930-1939¹

<i>Class</i>	<i>Grade</i>	<i>Average Prices per 100 Pounds</i>
Beef steers from the corn belt	Choice and prime	\$10.17
	Good	9.02
	Medium	7.67
	Common	6.32
	All grades	8.76
Veal calves	Good and choice	8.51
Cows	Good	5.75
	Cutter and canner	3.53
Heifers	Choice, 850 pounds down	9.37
	Good, 850 pounds down	8.30
	Common* and medium, 850 pounds down	5.96

* Eight years, 1930-1937.

Since steers and heifers are most in demand for beef, they are higher in price than cows. The lower grades of both steers and heifers are more nearly competitive with cows, but even the common grades in these classes outsell cows.

A comparison of grade differences in price indicates that there is about \$1.35 difference between grades within the classes of steers and heifers.

Receipts of Cattle at Public Markets by Months

The shipment of cattle to the market is seasonal. The heavy receipts occur in the fall of the year which is coincidental with the close of the pasture season and the necessary limitation of the cattle on the range. The monthly distribution of this movement of cattle and calves is shown by the tabulation on the opposite page.

The cattle receipts on the public market are the lowest in February, which is also a short month. Several other months are about the same in cattle receipts. The fall months are somewhat heavier in cattle marketings. Reshipment of cattle to the country as feeders and stockers is also heavier in the fall

¹ Data from *Livestock, Meat and Wool Market Statistics and Related Data, 1939*. Agricultural Marketing Service, U.S.D.A., May 1930. Mean of yearly means.

RECEIPTS OF CATTLE AND CALVES BY MONTHS
AT THE PUBLIC STOCKYARDSPer Cent by Month. Ten Years ¹

<i>Month</i>	<i>Per Cent of Cattle</i>	<i>Per Cent of Calves</i>
January	7.8	7.5
February	6.2	6.5
March	6.9	7.8
April	6.9	8.2
May	7.3	8.5
June	7.3	8.0
July	8.2	8.2
August	10.2	9.5
September	10.9	9.4
October	11.7	10.3
November	9.3	8.7
December	7.5	7.5
	100.0	100.0

of the year. There is less seasonality of cattle receipts than hog receipts.

Seasonal Variation in Beef Steer Prices

To analyze the cattle market, the various classes must be considered rather than the composite of all cattle. Receipts of cattle at public markets previously given indicate some seasonality in receipts of cattle and calves. The slaughter group is even more seasonal in movement because of the subtraction of feeder and stocker cattle and calves. Cattle feeding is seasonal in nature as feeders and stockers are available in large numbers and go into the feed lots in the fall. Beef steers, too, have a seasonality of marketing which is not the same for all grades. This is related to the prices of the different grades. A ten-year period of beef steer prices by grades on the Chicago market is shown in Figure 31.

As the lower grades of beef steers compete more directly with cattle from the range or with grass-finished cattle, the price is lower during the heavy receipt of such cattle in the fall. In fact, the prices of the lower grades show a tendency to follow feeder and stocker prices. Higher grades of grain-fed steers are not directly affected by lower finished cattle which causes a seasonal widening of spread, as indicated in the chart. The

¹ U.S.D.A. *Agricultural Statistics* 1939, p. 313.

better grades are also fed for long periods and on rations higher in concentrates. Although the chart indicates highs and lows of prices which are manifest for the ten-year period, it is made up

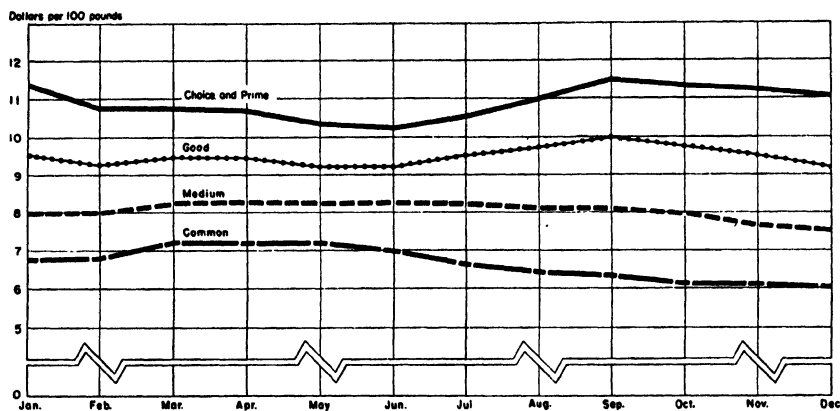


FIG. 31. Beef steer prices by grades. Union Stock Yards, Chicago. The price range narrows in the late winter and spring, and widens in the late summer and fall. (Bull. P. 5, Iowa State College.)

of yearly averages which present different patterns. Even within a narrow group the years are quite different in the average prices by months.

This is indicated from the following tabulation of high and low price months in a ten-year period for 1200- to 1500-pound beef steers on the Chicago market.

<i>Year</i>	<i>High Month</i>	<i>Low Month</i>
1939	May	August
1938	September	February
1937	September	December
1936	December	June
1935	April	November
1934	September	January
1933	July	December
1932	August	December
1931	January	May
1930	March	August

The high month or mode was September, which was high three out of ten times. No other month was high more than once. The low month also was in eight different months for the ten years. December was the mode for low with three.

Feed conditions and cattle prices affect markets so that usual effect of season may be masked.

Seasonal Variation in Heifer Prices

As would be expected, slaughter heifers of the better grade tend to follow the prices for the higher grades of fed steers. Over a period of eight years the choice and good heifers under 850 pounds in weight will be highest in price in the fall, usually September, and will be lowest in price in the spring, usually May.

Seasonal Variation of Cow Prices

In seasonal variation slaughter cow prices are quite the reverse of the prices for better grade heifers and steers, as the peak of prices is in the spring and low prices prevail toward the end of the year. This is due mainly to the marketing, which is extremely seasonal, as liquidation or culling occurs in the cow herd in the fall.

Seasonal Variation of Veal Calf Prices

Native veal calves which are mostly of dairy breeding also show a pattern of prices by months on the Chicago market. Receipts are quite seasonal as in dairy sections calves are dropped in the early spring and late winter and also in the fall. Veal calves are marketed when they are about two months of age, so peaks in marketing occur about two months after heavy calvings. Low prices attend heavier marketing, consequently low prices occur during April and May and also in November and December. Highs in prices occur mostly in the months of January, August, and September.

Following is a tabulation of native veal prices at Chicago for a ten-year period based on yearly averages by months. The high and low months by years are indicated.

AVERAGE MONTHLY PRICES AT CHICAGO FOR
NATIVE VEAL CALVES — 1929-1938¹

January	\$9.29	July	\$8.50
February	8.82	August	9.21
March	8.36	September	9.64
April	7.97	October	8.52
May	8.20	November	7.81
June	8.17	December	7.81

High year — 1929

Low year — 1923

¹ *The Drovers Journal, Yearbook of Figures, 1939.*

<i>Year</i>	<i>High Month</i>	<i>Low Month</i>
1929	September	May
1930	January	November
1931	January	December
1932	January	November
1933	September	June
1934	September	June
1935	August and September	January
1936	January	July
1937	August and September	April
1938	September	December
10-year average		\$8.53

Cash Income from Meat Animals

In agricultural income in the United States cattle and calves rank high; in fact, they return more cash income to the producer than all other slaughter animals together.

Following is the cash farm income from the different kinds of meat animals based on an eight-year period, 1932-1939, inclusive.¹

AVERAGE YEARLY CASH INCOME

<i>Kind of Meat Animals</i>	<i>Million Dollars</i>	<i>Per Cent of Total</i>
Cattle and calves	979	53
Hogs	717	39
Sheep and lambs	148	8
Total all meat animals	1844	100

All that is included under cattle and calves is not from beef cattle as it is the cash income from all cattle sold from farms for cash. Cattle and calves are the source of one-third more income to the producer than hogs and return to the raiser more than six times as much as sheep and lambs sold as meat animals.

¹ *The Livestock Situation*, B.A.E., U.S.D.A., May 20, 1940.

Chapter 7

FEEDER AND STOCKER CATTLE

CATTLE FOR FEEDING

Cattle feeding, or the finishing of range cattle, is quite widely distributed throughout the entire country but is primarily centered in the corn belt. In areas where feed grain is produced extensively the cattle feeder either raises cattle and feeds them until they are acceptable as slaughter cattle or secures feeder and stocker cattle from other areas for feeding. The unfinished cattle move to regions of surplus feed for finishing. The general movement is from the range areas of the great plains and the Rocky Mountain states to the corn belt and other feeding regions for finishing. The finished beef is then moved eastward toward the large centers of human population.

There are some other special feeding areas. Notable among these are the cake feeding areas in Texas, the beet pulp feeding section in Colorado, Nebraska, and Wyoming, and the Lancaster district in Pennsylvania. In some areas cattle are purchased for the utilization of concentrates mainly, with just sufficient roughage or pasturage to complete the ration. In other areas cattle are brought in to utilize pasture or roughage.

Range Cattle

The cattle from the range country are largely of Hereford breeding. In feeder cattle, therefore, this breed predominates although feeders of the other breeds are not uncommon. Cattle of nondescript and dairy breeding, too, are wholly or in part sold as feeders. In general, to classify either as a stocker or a feeder, the individual must be produced primarily for beef and be well past the veal calf stage. Such cattle must show evidence of ability to take on additional weight and finish, and consequently be in demand by feeders.

The essential feature in profitable livestock raising in the

cattle ranching areas is low-cost feed. Successful management of the range depends upon the use of the proper number of grazing livestock of the kind suited for the range and the proper distribution of the livestock over the grazing area.

Growth of Range Cattle

As the feed supply is somewhat seasonal on the range, cattle there are subjected to different kinds and rate of growth at various seasons of the year. Under corn belt and similar conditions the rate of growth is not so directly related to the natural vegetation available as grazing provides but a part of the feed supply. In the range country supplementary feeding is practiced. This consists mainly of the feeding of some protein supplement and hay. The extent is variable in different areas and also dependent upon the grass available.

Lush *et al*¹ studied the normal growth of range cattle at the Texas Ranch Experiment Station at Spur, Texas. It was found in this investigation that the increase in weight with growing cattle on the range was usually very rapid from the middle of April until late summer, and in the fall months the rate slowed down, while in the winter it was nearly at a standstill. Actually losses in weight occurred in the late winter and early spring. The growth of the skeleton, especially the head and the length of the leg bones, was not affected by the paucity of feed in the winter period. However the growth of the pelvic bones, increase in body length and chest depth are somewhat lessened during the winter.

Range cattle that are young may not gain in weight during the winter if kept on the range, but they will be older in appearance because of the growth of the head, legs, and hair.

Marketing of Cattle for Feeding

There are three main channels in common use in the movement of cattle from the raiser to the feeder. The greater number pass through the public central market and are consigned to commission men who act as agents for the owner. Buyers of feeders may make their own selection at the central market or

¹ Lush *et al.*, "Normal Growth of Range Cattle," *Bull.* 409, Texas Agr. Exp. Sta., March 1930.

make purchases through commission men. Many feeder cattle are consigned to auction markets which are available to both buyers and sellers. A large number of feeder cattle are purchased direct from the raiser either by the feeder or an intermediate agent.

Large Feeder Cattle Markets

Most of the large central markets for feeder cattle lie between the range area and the corn belt where most of the cattle are fed out. The receipts on these markets are variable and their rank in numbers of feeder cattle sold is changeable. When drought or other conditions cause a liquidation in any area the receipts on the markets serving that area are increased.

Following are the large markets of feeder and stocker cattle, based on receipts for a ten-year period.

LARGE CENTRAL MARKETS FOR FEEDER CATTLE

Average Yearly Receipts for the Ten-Year Period, 1930-1939 ¹

<i>Market</i>	<i>Average Yearly Receipts, Thousand Head</i>
Kansas City, Missouri	567
Omaha, Nebraska	312
Sioux City, Iowa	207
Denver, Colorado	200
South St. Paul, Minnesota	195
Fort Worth, Texas	131
Wichita, Kansas	117
El Paso, Texas	90
East St. Louis, Illinois	86
Lancaster, Pennsylvania	81
Oklahoma City, Oklahoma	78

The range cattle raiser may dispose of his cattle by sale, as feeder calves, as yearlings, or as two year olds and older, or he may have them fed out on account or on contract, or he may have them pastured on contract. If sale is made they may be sold direct or through some agency or on a central market. In recent years there has been a decline in the movement of cattle from the public markets and an increase in the direct-to-feeder movement. About 3 million head of feeder cattle pass through the central markets each year.

¹ Data from Agricultural Marketing Service, U.S.D.A. Source, *The Drovers Journal Yearbook of Figures*.

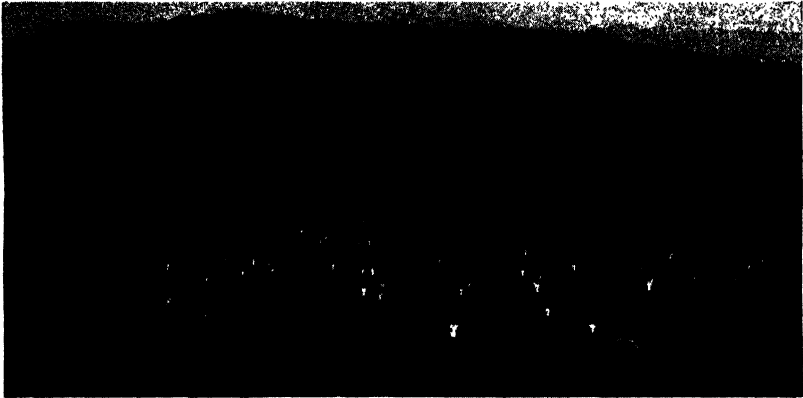


FIG. 32. A beef breeding herd in the intermountain region.

Growth of Direct Marketing with Feeders and Stockers

Data are not available on the extent of direct marketing of feeder and stocker cattle. That it has increased is shown by the proportion of the cattle which are shipped from the public stockyard markets by periods. The following data indicate indirectly what has happened to the purchase of feeder and stocker cattle.

PERCENTAGE OF THE CATTLE RECEIVED SHIPPED FROM PUBLIC MARKETS

1920-1924	49.9
1925-1929	41.0
1930-1934	33.0
1935-1938	33.0

It is apparent that more of the cattle received on the public market are slaughtered than formerly. In the early '20's about one-half of the cattle on the markets were reshipped, while in the early '30's but one-third were reshipped. The growth of the direct movement is accompanied with a lower proportion of cattle on public market being shipped out for feeders.

Movement of Feeder and Stocker Cattle

The peak in the movement of feeder and stocker cattle is in the fall period. About 50 to 55 per cent of the shipment of such cattle occurs during the months of August, September, October, and November. The end of the grazing period causes the cattle

to move from the range country and also at this time there is an abundant supply of feed in the feeding areas.

The ranchman sells his surplus stock in the fall unless supplemental feed is relatively cheap and the probable price in the spring appears favorable. Seldom is there much of an increase in winter season; consequently, cattle on the range are reduced to a minimum in the fall. If prospective feeder cattle have been carried over the winter on the range, the summer range pasture available can in most instances carry them until fall.

Nearly one-fourth of all cattle received on the public markets during the fall are shipped out as feeders and stockers. Mid-western farmers provide a demand for thin cattle to be used for fall grazing, roughage feeding, and grain feeding, particularly corn from the current crops.

With the demand for lighter beef, smaller cuts, and higher quality, there has come a great increase in the marketing of younger feeder cattle, mainly feeder calves. Cattle that mature more rapidly and finish at younger ages have been developed. The tendency has been for a decided increase in the marketing of calves and a decrease in the receipts of two year olds.

Seasonal Variations in Shipments of Feeder Cattle from Central Markets

As has been indicated previously, the fall is the heavy market period for feeder cattle. However, cattle are shipped from the central markets every month of the year, and this represents a sizable portion of the total receipts. The monthly distribution of this movement is shown in the following tabulation:

SHIPMENTS OF FEEDER AND STOCKER CATTLE FROM CENTRAL MARKETS BY MONTHS

Per Cent per Month, Ten Years, 1930-1939

<i>Month</i>	<i>Cattle</i>	<i>Calves</i>
January	5.8	6.6
February	4.5	5.1
March	5.3	6.1
April	5.7	6.5
May	5.8	6.6
June	4.9	4.2
July	6.4	4.9
August	10.6	7.8
September	13.3	10.4
October	17.8	18.5
November	12.8	17.5
December	7.2	9.3

The two groups move together in rather close agreement, as noted from above data. As would be expected, the movement of cattle and calves to the feed lots is more seasonal than the total receipts.

Reasons for Market Groups

Trading in feeder cattle is facilitated by the use of market classes and grades. The standardization of terms, classes, and grades makes it possible to describe quite accurately the offerings of sellers and the requirements of buyers. A common understanding for trading is made possible by the use of standard grouping and suitable descriptive terms commonly used. A definite class and grade then have certain characteristics which are related to market value. From market reports given by the press, radio, mail, and wire, buyers can compare various markets where feeders are available.

The Bureau of Agricultural Economics of the United States Department of Agriculture collects and reports on the feeder cattle markets and movement of feeder cattle so that comparisons of various markets can be readily made.

Groups of Cattle That Are Sold for Feeding

Cattle are sold either to slaughterers or to feeders. There is competition between the two groups for cattle that are carrying some finish — which are known on the market as “two-way cattle.” In classifying and grading feeders and stockers, the class, age, weight, and grade are considered. The raiser, the feeder cattle dealer, or the yard trader arranges uniform lots of cattle acceptable to the feeder buyers. The outlook for cattle feeding influences the demand for cattle for feeding. When the ratio of feed costs to finished cattle is favorable, the number of cattle purchased for feeding is increased. This decreases the number of thinner cattle available for immediate slaughter, but as a consequence finished cattle will increase proportionally later. The corn belt farmer or other feeder sells his feeds in the form of finished cattle. When the margin between the price of slaughter and feeder cattle is wide, more feeding results.

Following is a tabulation of the different market classes and

grades which may be on the market, and a brief description of each group.

MARKET CLASSES AND GRADES OF FEEDER AND STOCKER CATTLE

	<i>Basis for Grouping</i>				
	<i>Sex Classes</i>	<i>Age</i>	<i>Use Selection</i>	<i>Weight</i>	<i>Grades</i>
<i>Divisions in each group</i>	Steers Heifers Cows Stags Bulls	Calves Yearlings Two year olds and older	Stockers Feeders	Heavy Medium Light Mixed	Fancy Choice Good Medium Common

SEX CLASSES

In the usual classification these are regarded as the market classes of feeder cattle. In some classifications the entire group is termed a market class which is taken as being based on a commercial use. Since cattle in this group are sold for further feeding they are designated as stockers and feeders to distinguish them from beef steers, butcher stock, cutters and canners, etc., and the sex classes are regarded as subclasses.

The market classes of stockers and feeders based on sex or sex condition is the main market classification. The terms descriptive of the sexes and sex condition have been previously described on page 79.

Steers predominate in the feeder and stocker receipts. Some heifers¹ and cows are included in this division, and occasionally bulls and stags are sold as feeders. Unless otherwise qualified, however, a feeder or stocker is a steer.

AGE GROUPS

As range calves are dropped mostly in the spring of the year, it is common practice to group cattle sold for further feeding into age divisions. This grouping applies mainly to steers and

¹ Spaying or unsexing of heifers is not common. Although such heifers are more quiet in the feed lot than open heifers, the operation is rather difficult and practically no premium is paid for spayed heifers when marketed. There is no advantage in buying spayed heifers in preference to open heifers for feeding. Feed consumption and costs of gains are not affected by spaying.

heifers. Offerings consist mainly of calves, yearlings, and two year olds for both steers and heifers, but there are fewer of the older heifers sold. The age of cattle when put on feed is related to such factors as the length of the feeding period, rate of gain, and kind of feeds needed. It therefore is an important problem confronting the prospective feeder. Young cattle will make growth while in the feed lot whereas in older cattle there is less growth and more fattening. Young cattle, therefore, put on gains more cheaply than do older cattle because their gains are higher in moisture and lower in fat.

FEEDER AND STOCKER CATTLE

Stocker cattle are usually younger and less mature than feeder cattle. Also, stockers are intended for the utilization of more grass and roughage than feeders and as a consequence they are fed longer before they are returned as slaughter cattle. Stockers are not fattened immediately but are allowed to grow out on roughage before fattening. Feeder cattle on the market usually are higher in flesh and finish than stockers, but the distinction is arbitrary and based mainly upon the subsequent feeding and management.

With the increase of rapidity finishing of young feeder cattle (calves and yearlings) the term "stocker cattle" has largely lost its significance, especially in the corn belt.

WEIGHT GROUPS

Cattle for feeding are sorted in weight groups to secure more uniform lots for feeding. Yard traders on central markets often perform this function. The subdivisions on weight are not widely standardized. Often the terms "heavy," "medium," "light," and "mixed" are used to describe lots sorted for sale. The weight which is associated with age and fleshing is an important consideration in determining the feeding system to be used. The heavier cattle need a shorter feeding period and require a smaller necessary margin, because of the increase in value of a greater weight.

GRADES

A grade includes animals that will sell for about the same price per pound. It is the last step in sorting or grouping for

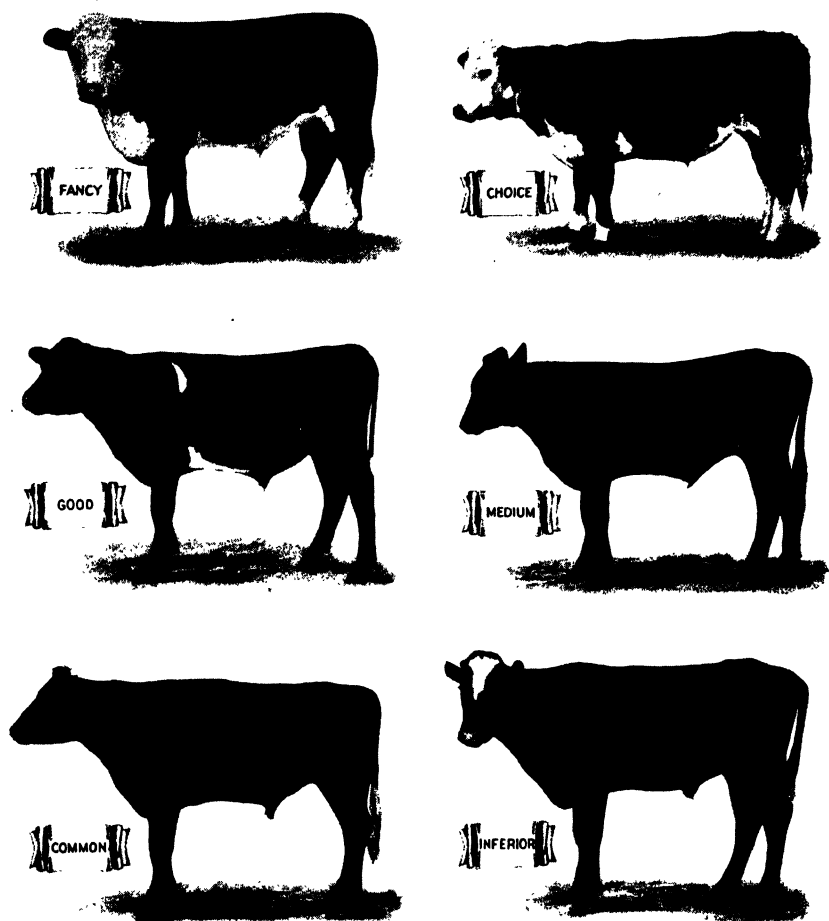


FIG. 33. United States grades of feeder steers. (U.S.D.A., Agricultural Marketing Service.)

the marketing of a lot of cattle. We recognize five common grades,—fancy, choice, good, medium, and common,—although in some instances two of the grades may be joined together. For example, we may read of a quotation on heavy steer calves good to choice grade. In fact, it is common practice to combine the good and choice grades. See Figure 33.

Grade Factors

The evaluation of feeder and stocker cattle is based upon certain requirements which are grouped under the considerations



FIG. 34. Example of a poor feeder steer. Note the long legs, low back, rough and irregular fleshing, shallow body, and lack of blockiness desired in a beef steer.

of: (1) conformation, (2) quality, and (3) finish. These terms have been previously described under finished cattle in Chapter 4. A further discussion as to their application to feeder cattle follows.

CONFORMATION

Conformation is the form, shape, or general outline of the feeder. It is determined by the width, depth, compactness, low-setness, straightness of lines, and symmetry or balance of parts. Strong constitution and feed capacity are essential for good feed lot performance. A top-grade feeder steer is wide, deep, compact, low set, and has a straight top line, under line, and side lines. The head is short and wide, the neck short and thick, and thickness of fleshing or "natural fleshing" is evident in the crops, back, loin, and rounds.

A low-grade feeder steer of poor conformation is rangy, leggy, narrow, shallow, and not symmetrical. The head on such a steer is long and narrow, the neck long and thin, and the crops, back, loins, and rounds are sparsely fleshed.

QUALITY

Quality refers to the general refinement or the lack of coarseness. It is highly related to breeding. Good breeding means



FIG. 35. Feeder calves of the correct type. Grand champion load of feeders at the 1940 International Livestock Exposition. Bred and exhibited by Fred DeBerard, Kremmling, Colo.

good quality. Purebreds or high grades or crossbreeds from good beef breeding have good quality. The general smoothness and refinement of the bone, hide, and head indicate the quality. Feeder steers of high quality are smooth in form and fleshing and not heavy or coarse in the head, hide, or bone. However, ample bone is desirable as is a wide, short, clean-cut head and mellow hide. Refinement can be carried too far. A feeder steer of desirable quality should have sufficient ruggedness so that it will do well under feed lot conditions and sufficient refinement to yield a carcass of high quality.

Low-quality feeder steers lack in beef breeding and are coarse, or rough in form and fleshing, and of heavy bone and heavy tight hides. Even with good feeding low-quality feeder steers seldom develop into finished steers that yield high-grade carcasses.

FINISH

Finish refers to the amount and distribution of fat. As the finish of cattle is increased the market class is shifted to the slaughter class. Feeders with greater finish require less feeding and consequently a shorter feeding period to produce finished market cattle. The finish on feeders is dependent upon the inherent qualities of the cattle and also the environmental conditions. Finish is therefore an indication of the capacity to make gains under the feeding conditions in which the cattle have been raised. Thrifty cattle carry finish while unthrifty cattle lack fleshing.

Feeder cattle that have been under poor conditions nutritionally present a problem. Severe retardation of growth may influence the outcome of cattle. The lowered growth rate coincident with the winter season arrests maturity but probably does not stunt range cattle. Range conditions affect the market movement of the range cattle and also the fleshing carried by the cattle. A well-bred feeder in rather poor flesh or condition may be a very desirable feeder. However, stunted animals usually make slow, uneconomical gains even though their ultimate size may not be affected by prolonged periods of underfeeding. Range cattle that are underfed to the extent that they are not changing in weight change in form because of growth.

OTHER FACTORS THAT MAY INFLUENCE GRADE

Conformation, quality, and finish to a large extent determine the market grade of feeders. Yet other factors influence grade, some of which overlap the factors previously stated. The grade is affected by several other items which are related to the capacity and ability to consume and convert feeds in economical gains.

Following are some of the other factors which may affect the feeding possibilities of feeders.

a. BREEDING. The differences in breeding are quite largely reflected in conformation, quality, and finish. In the selection of feeders enough emphasis is given this point to warrant separate consideration.

Purebred cattle or high grades will usually make more rapid gains in the feed lot than scrubs, and also their gains are made



FIG. 36. Finished steers in the feed lot. Fred Atterbury, Mitchell, Nebr.

with less feed. The big difference in the cattle of poor breeding and better breeding, however, is that the well-bred steers will sell for much more when finished because of the higher acceptability of the carcass when finished rather than the rapidity and economy of gains. Feeders of poor breeding or scrubby-like are not finished as highly as feeders of better grades. The carcasses of scrubs are of lower grades because of inferior quality

and conformation, and it is not economical to fatten them heavily because that will not make up for the deficiency in form and quality.

Steers of good beef type will yield a relatively large percentage of carcass. Also carcass from such steers will have a higher proportion of loins and ribs (higher priced cuts) and a lower proportion of cheaper cuts. The difference in the percentage of cuts is not great. Fat distribution on well-bred steers is more desirable as is also the quality of the beef.

b. HORNS. Most of the cattle which are sold for further feeding are hornless. They are either of hornless breeding or



FIG. 37. Western range raised steers finished in the corn belt. Champion carload of Shorthorn steers, 1940, International Livestock Exposition. Bred and raised by Josef Winkler, Castle Rock, Colo., fed and exhibited by James Blair, Dayton, Iowa.

dehorned when young on the range or during the marketing process. Feeders that are horned are worth at least 25 cents less per hundred pounds than those without horns because they require more room and may make less rapid gains. Young cattle that are not hornless should be dehorned if they are to be kept for a feeding period of the usual length. Older cattle are set back more by dehorning, and the loss from the setback may be more than the losses due to the horns.

Cattle with horns are less satisfactory in the feed lots and incur damage from horn bruises in loading and shipping. Horns are one of the major causes of bruising in cattle being marketed, and slaughter cattle with horns sell at a lower price because of damage to the hide and carcass.

c. HEALTH AND THRIFTINESS. It is quite obvious that diseased or unthrifty cattle will not respond with good gains in the feed lot.

d. TEMPERAMENT AND DISPOSITION. A nervous, irritable, high-strung feeder will not make fast, economical gains. Muscular activity increases energy production, and consequently less of the energy in the feed consumed by an active steer is available for body gains. It has been estimated that there is an increase in metabolism from 20 to 30 per cent by a standing steer over one that lies down.

Calves from Cows Compared with Calves from Heifers

Calves from cows are usually heavier than those from heifers when they are sold from the range herd in the fall. Some evidence on the feeding outcome of calves under corn belt conditions apparently indicates that the feed lot performance of cow's calves is not sufficiently superior to the performance of heifer's calves to be an important factor in the purchase of feeder calves.

Best Indices of Feeder Grade¹

What characteristics are indices of the grade of a feeder? The following five characters judged by graders have been studied in relation to the grade of feeder cattle. Width and depth of body, thickness of finish, shape of head, and refinement (quality) were all found to be highly correlated with the grade of the feeder. Width was the best single index of the characters studied, while refinement ranked lowest.

It was found also that the physical characters judged or estimated were rather highly correlated with the final carcass grade of the cattle. These estimates made by grading experts showed close agreement between feeder characteristics and carcass value of the steers when finished.

Grades of Feeder and Slaughter Steers

There is a rather high correlation between the grades of feeder steers and the grades of the resultant finished steers. The amount and quality of the ration and the length of the feeding

¹ O. G. Hankins and L. R. Burk, "Relationships among Production and Grade Factors of Beef," *Tech. Bull.* 665, U.S.D.A., November 1938.

period are the principal factors affecting the final grading of the slaughter steer. A choice feeder steer will, if properly handled, produce a choice finished steer. The grade may decline if the animal is not well fed. On the other hand it is possible to improve the grade with good feeding and handling. Better grades require heavier grain feeding and a longer feeding period than the poor grades. With usual feeding conditions, the poorer grades tend to improve in grade while the better grades tend to decline.

ECONOMICS* OF CATTLE FEEDINGS

Skillful buying and selling are essential for profitable cattle feeding. Economical feeding will not overcome poor judgment in buying feeders or selling the finished cattle. As the cost per hundred pounds of gains is usually higher than the market price per hundred pounds of finished cattle, a margin is necessary for profit from cattle feeding.

Margin in Cattle Feeding

The difference between the buying price of a feeder or stocker and the selling price of the finished steer per hundred pounds is



FIG. 38. Prime baby beefs from Texas ranches and feed lots.

termed "margin." The difference needed to break even on the cattle feeding enterprise is the necessary margin. There are many variables which influence the necessary margin. The

most important items to be covered are the cost and amount of the gains and the expense of getting the cattle to the feed lot and marketing when finished. Heavy cattle require less margin per head to break even than lighter cattle because a greater initial weight is increased in value by feeding. Likewise, higher priced cattle require less margin because the original cost per pound is more nearly equal to the cost of the gain. Young cattle require less feed to make gains and cost more than older cattle; therefore, they have a lower necessary margin.

Grade of Cattle to Feed for Profit

Supply in proportion to demand establishes the price of feeder cattle. Higher grades, such as choice and good, sell for more than the lower grades like medium or common because of demand. The better grades usually make greater daily gains and require less feed for their gains. Likewise the higher grades require less margin for an equal length feeding period, and also, when finished, they grade higher and sell for higher prices. The higher grades commonly use a larger proportion of concentrates and are fed longer periods and to higher finish.

Lower grades of feeders may be as profitable as higher grades as they cost less and use feeds of lower cost. The margin may be as wide or wider for low grades as high grades. The spread between grades does not remain constant, and the difference between various grades is the same for finished and feeder cattle.

In Figure 39 the average price for stocker and feeder cattle, and slaughter steers, is given. It will be noted that prices of feeder and finished cattle tend to move together, also there is a seasonal fluctuation. Stockers and feeders are higher priced during the spring and early summer because of the demand for pasture feeding. Receipts of unfinished cattle are heavier when the pasture season closes, so lower prices prevail.

During the spring the spread in grades of slaughter cattle narrows and in the fall the extreme in grades tends to diverge more from the average. This is due to the variable demand which exists and the supply available to meet that demand. Finished cattle of the higher grades are fewer and higher priced on the market in the fall. Poorer grades of finished cattle are

relatively cheap in the fall because of the great number of partly finished cattle then on the market that are pasture fed.

The corn crop influences the number of cattle fed and also probable margin. With a larger than usual corn crop a heavy demand for feeders results. This is followed by a larger than

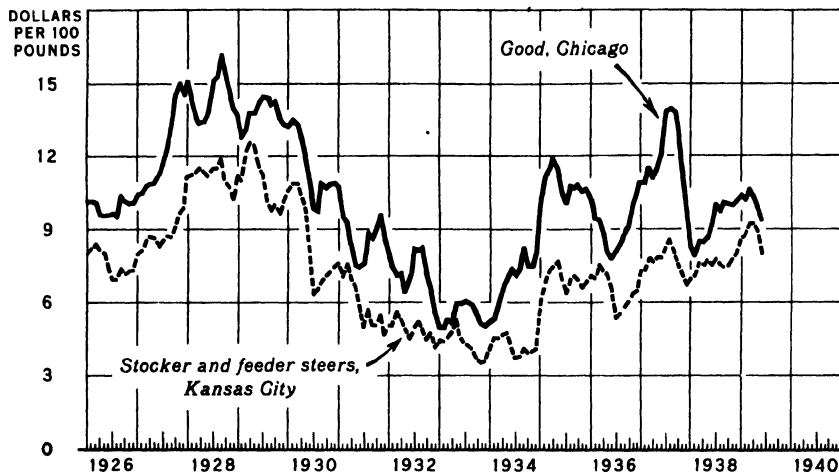


FIG. 39. Average prices of stocker and feeder steers and of good slaughter steers, 1926-1939. It will be noted that prices for the two groups tend to move together. (U.S.D.A., Bur. of Agri. Economics.)

normal supply of fed cattle when the cattle are finished and consequent narrow margins. A light movement of feeder and stocker cattle in the fall will usually result in a short supply of finished cattle and wider margins.

Feeder cattle of the same market grade vary in their ability to make economical gains. Steers that make rapid gains and also sell high will bring a high net profit.

Age of Feeder Cattle and Economy of Gains

The relationship of age to gains and economy of gains is shown by a summary made by Morrison.¹ The weight groups and their daily gains and nutrients needed for gains follow.

¹ F. B. Morrison, *Feeds and Feeding*, 20th ed., Morrison Publishing Co., 1936, p. 643.

DAILY GAINS AND NUTRIENTS REQUIRED BY STEERS
OF DIFFERENT WEIGHTS

<i>Weight Group, Pounds</i>	<i>Average Daily Gain, Pounds</i>	<i>Total Digestible Nutrients for 100 Pounds Gain, Pounds</i>
100-200	0.93	225
200-300	1.33	319
300-400	1.44	376
400-500	1.51	429
500-600	1.85	426
600-700	1.71	529
700-800	1.79	553
800-900	1.53	708
900-1000	1.62	731
1000-1100	1.53	808
1100-1200	1.48	885

It will be noted that the daily gain increases for a time with the increase in weight and then declines. The digestible nutrients increase quite regularly with weight and age because the older and heavier cattle require more feed just to maintain their weight and their gains are composed of a larger proportion of fat which because of its concentrate nature requires more feed.

The feed requirements for feeder steers of good grade, fed on dry lot, are given in the *Cattle Handbook*¹ as follows:

<i>Age Group</i>	<i>Daily Gain, Pounds</i>	<i>Feeding Period, Days</i>	<i>Pounds of Feed for 100 Pounds Gain</i>			
			<i>Corn</i>	<i>Corn Silage</i>	<i>Alfalfa Hay</i>	<i>Cottonseed Meal</i>
Calves (350 to 500 pounds)	1.77	225	340	835	139	90
Yearlings (500 to 700 pounds)	1.90	195	410	972	156	87
Two year olds (650 to 900 pounds)	2.10	165	453	1006	156	84

Lightweight, younger feeders require a longer feeding period while older cattle may be fed for a short time (warmed up). With older cattle of comparable grades the grain to roughage ratio on the dry-matter basis is narrower and the proportion of protein supplement lower.

¹ *Cattle Handbook*, National Livestock Marketing Association, Chicago, 1935.

Contract Feeding of Cattle

Contract pasturing of livestock is of long standing in this country, but it has been only in the last decade that contract feeding has been practiced in any volume. In such arrangement the grower supplies the cattle; the feeder furnishes the feed, equipment, and labor. The feeder receives his returns on the basis of the increase in the weight of the cattle. Such items as marketing expense, freight, etc., are included in the contract agreement. Under conditions of low prices for feeders and feeds and also curtailment of livestock credit, contract feeding increases. The feeder risks his feed and labor while the ranchman risks his cattle in the contract feeding, and in the cooperative venture a greater return is expected for both the cattle and feed than by immediate sale.

In general, feeders have not been too well satisfied by contract feeding. Most of the complaints have been on the weights, sorting, and shrinkage of the cattle which is commonly done at range loading points. With sufficient margin between the immediate sale price of feeders and the final sale price of finished cattle to pay for all costs involved, contract feeding will be successful provided the contract is equitable to both the grower and the feeder.

Crops Raised and Cattle Feeding

With the shift in the crop production on corn belt farms to more land in grass and less in grain the question arises as to the effect that this change may have upon the livestock production. Farms in this region having more than the usual amount of land in grass also raise more than an average amount of all livestock. Increased production of soil conserving crops will not reduce total feed production, as soil depletion is halted crop yields are maintained or enhanced. Greater acreage in pasture or hay land is usually accompanied by increased livestock numbers to utilize the roughage produced. This will increase the feeding of home-grown concentrates and consequently decrease the cash grain sold. A comparison of grass and grain crop rotations on midwestern farms indicated that the former yielded a greater amount of feed units (corn or corn equivalent) with a lower production cost.

Raising Calves or Buying Feeders on Corn Belt Farms

Investigations have indicated that under normal conditions the average farmer in the corn belt is able to raise calves for feeders about as cheaply as he can buy them and ship them in from adjacent markets. Raising the feeders and maintaining a beef breeding herd will, however:

1. Furnish a home market for a large amount of roughage for which there would be little other use; also for salable crops.
2. Make use of pasture land.
3. Provide employment for labor which at certain seasons of the year may be idle.
4. Provide a use for equipment such as barns and lots.

It is quite evident that the economics of raising feeders on an individual farm should be decided upon the basis of the resources for growing cattle on the farm. There may be years when feeders can be purchased more cheaply than they could be raised, but in those years the feeders are probably not profitable to the ranchman. In order to compete in the farming area, cheap pasture and roughage are needed.

Chapter 8

CATTLE SLAUGHTERING, PROCESSING, AND BY-PRODUCTS

CATTLE SLAUGHTER AND PROCESSING

Meat packing is a misnomer, as there is very little meat packed at the present time. This term came about from the "salting down" or "packing" of meats which dates back to colonial days. In the absence of refrigeration the colonist salted down or barreled meat for the winter season. The Civil War in England in 1640 brought a stop to the trade with the West Indies in which livestock, barreled pork and beef were exchanged mainly for molasses. The New Englanders absorbed this trade with the West Indies, causing a growth of the cattle and hog production and meat packing for shipment in America.

Development of the Meat Packing Industry

Compared with the present meat packing industry, pioneer livestock slaughter plants were crude and inefficient. When first established, meat packing was a seasonal industry, as slaughter was done mostly during the winter months. Cincinnati, shortly after 1830, became a leading meat packing center. It was named "Porkopolis" because it had "perfected the system which packs 15 bushels of corn into a pig and packs that pig into a barrel and sends him over the mountains and over the ocean to feed mankind."

Later packing plants were established at Chicago and Milwaukee. As the growing of livestock moved westward, the meat packing industry followed in its wake. Cities on the Missouri and Mississippi Rivers developed into meat packing centers. These are the river markets and include South St. Paul, East St. Louis, Sioux City, Omaha, St. Joseph, and Kansas City. Later other large slaughter points came into being at

Denver, Fort Worth, and other cities west of the original river markets. Decentralization of meat packing, or the development of the interior markets, started in the early 1920's. Meat packing has always moved toward livestock production, which tends to minimize livestock shipping losses.

The development of mechanical refrigeration permitted expansion of the industry. Up to the time of the Civil War, meat packing was principally pork because much of it could be cured. Railroads were responsible for the location of large cattle markets, and refrigerator cars made it possible to move fresh beef some distance from the place of slaughter. The first practical refrigerator car used by western meat packers was designed by G. H. Hammond in 1875. A mechanical refrigeration plant in conjunction with a meat packing house was used first in Chicago in 1880, and beginning about 1890 mechanical refrigeration gradually replaced natural refrigeration.

Present Status of the Meat Packing Industry

There are nearly 1000 meat packing companies in the United States operating more than 1200 meat packing plants. Livestock is slaughtered at over 600 of the latter group, while the balance are involved in meat packing other than slaughter. In the value of its products, the meat packing industry is exceeded only by the motor vehicle industry.

The chief manufacturing industries in the United States were ranked in the 1935 census of manufactures as follows on the basis of the plant value of the products:

1. Motor vehicle not including motorcycles.
2. Meat packing.
3. Steelworks and rolling mill products.
4. Petroleum refining.
5. Motor vehicle body and parts.

The plant value of meat products for 1935 was 2362 million dollars.

Modern Meat Packing Companies¹

The functions of the meat packing company in which all of the phases of the business are carried on are as follows:

¹ *The Meat Packing Industry in America*, Swift and Co., 1937.

1. The primary task is that of transforming cattle, calves, hogs, and sheep into fresh beef, veal, pork, and lamb. This is the fresh meat service of the packing industry.

2. The production of cured meats, particularly the pork products as ham, bacon, and shoulders. This also includes the production of corned beef and dried beef, as well as barreled pork and beef. This function permits a more uniform spread into consumption of rather uneven seasonal receipts of slaughter animals. Also, the availability of cured meat adds to the range of food selection for our diets.



FIG. 40. The modern packing plant. (Swift and Co.)

3. The production of manufactured food products. Some of the products from livestock slaughter are altered by a manufacturing process into acceptable food products. This includes such processing as the manufacture of (1) sausage from the blending of various meats with other ingredients, (2) margarine from beef fats blended with vegetable oils and milk, (3) meat products marketed as specialty products in a variety of forms, some of which are canned, such as meat loaf, head cheese, etc., (4) vegetable products such as lard substitutes, vegetable margarine, salad oils, and cooking oils.

4. The processing of a large number of materials from the edible by-products. Such things as the hearts, livers, kidneys,

sweetbreads, tongues, tripe, casings, oleo oil, lard, edible tallow, and gelatin are distributed as food products. A large number of biological materials obtained from livestock slaughter, such as renin, pepsin, thyroid extract, insulin, and adrenalin, are used for medicinal purposes.

5. The recovery and processing of inedible by-products. In this group of materials are the hides used for leather, wool, bones, blood, tankage, greases, soap, glue, and many others.

6. The large packing companies have in many instances expanded their range of products to include poultry, butter, eggs, and cheese. These products are handled with meats because of their similarity in general characteristics. Refrigeration and quick distribution are essential in the successful handling of dairy and poultry products as well as meat.

Cattle Slaughter and Method of Disposition

The retail and home slaughter are important outlets for market cattle and calves. The cattle and calves which are

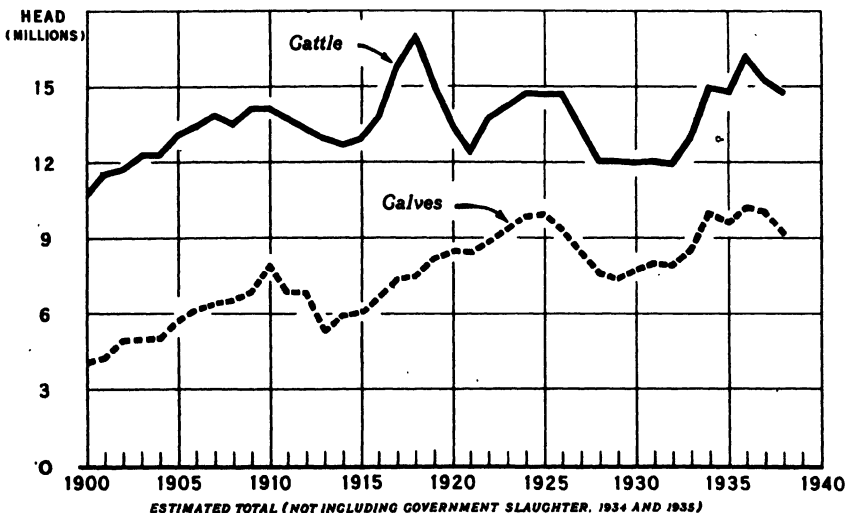


FIG. 41. Slaughter of cattle and calves. In the past 30 years, the long-time trend of cattle slaughter has been neither upward nor downward. The trend of calf slaughter has been sharply upward. (U.S.D.A., Bur. of Agri. Economics.)

slaughtered by most fairly large packing plants are subjected to federal inspection. The total slaughter of cattle and calves by

years is shown in Figure 41. The Meat Inspection Act, which became effective October 1, 1906, pertains to antemortem examination and inspection of all cattle and of the meat and meat food products which enter into interstate and foreign commerce. The meat packing plants may be divided on the basis of their use of federal inspection and the nature of their business, that is, whether wholesale or retail. Following is an estimated breakup of cattle slaughter for a recent five-year period.

CATTLE SLAUGHTER CLASSIFIED BY
NATURE OF BUSINESS

	<i>Cattle</i> (Per Cent)	<i>Calves</i> (Per Cent)
Wholesale		
<i>a.</i> Federally inspected	67	60
<i>b.</i> All other	15	14
Retail	13	17
Farm	5	9

Meat packing is essentially a wholesale business. More than three-fourths of the total cattle slaughtered in the United States are slaughtered by packing plants conducting a wholesale business. Most of the beef and veal handled by such concerns is federally inspected. About 15 per cent of the cattle and 14 per cent of the calves slaughtered are handled by local packing plants which dispose of their products within the state in which they are located. Although these plants and their products escape federal inspection, they are under the inspection of the state in which they operate. These plants account for a considerable portion of the retail slaughter as well. This method absorbs 13 per cent of the cattle and 17 per cent of the calves slaughtered. In this case the meats are distributed through meat shops which are a part of the organization controlling the packing plant.

Farm slaughter is mainly for home consumption, though some portion of meats so derived may enter the meat trade. About 9 per cent of calves and 5 per cent of cattle slaughtered are disposed of by this method.

Shifts have taken place in these various avenues of disposition. Home or farm slaughter is stimulated in times of low cattle

prices because the costs of meat distribution remain quite constant and make up a larger percentage of the cost of the meat to the consumer when slaughter cattle are low priced. There has been an increase in recent years in the slaughter of cattle and calves by wholesale establishments both under federal inspection and otherwise. Retail slaughter, and to a lesser extent farm slaughter, have declined.

Leading States in Meat Packing

Based on the plant value of packer products two midwestern states, Illinois and Iowa, rank first and second, while New York is third. This is on the basis of all meat products, not just beef and veal. The states are ranked as follows in the plant value of packer products.

THE MEAT PACKING INDUSTRY BY STATES (1935)¹

U. S. Department of Commerce Data

	<i>Number of Meat Packing Establishments in State</i>	<i>Plant Value of Meat Packers' Products</i>			<i>Rank of Meat Packing among All Industries of State—1933</i>
		<i>Amount</i>	<i>State's Per cent of Total</i>	<i>Rank of State</i>	
Illinois	79	\$494,401,747	20.93	1	1
Iowa	23	205,999,101	8.72	2	1
New York	87	157,973,444	6.69	3	6
Minnesota	14	150,969,114	6.39	4	1
Kansas	33	145,942,853	6.18	5	1
California	116	120,563,585	5.10	6	3
Ohio	128	109,891,813	4.65	7	7
Nebraska	17	105,510,787	4.47	8	1
Missouri	45	104,455,094	4.42	9	1
Pennsylvania	134	100,453,515	4.25	10	10
New Jersey	29	76,015,870	3.22	11	6
Texas	40	73,557,416	3.11	12	3
Indiana	53	72,249,361	3.06	13	5
Wisconsin	22	61,526,519	2.60	14	4
Massachusetts	27	46,632,759	1.97	15	14
Michigan	43	44,762,597	1.89	16	14
Oklahoma	20	37,356,642	1.58	17	3
Maryland	37	32,619,280	1.38	18	4
Colorado	19	31,673,264	1.34	19	1
South Dakota	7	30,651,639	1.30	20	1

¹ Institute of American Meat Packers, *Reference Book of the Meat Packing Industry*, 1938.

Centers of Cattle Slaughter

At most large markets there is a heavy slaughter of cattle, but the markets do not rank the same on receipts and slaughter. The slaughter of cattle at central cattle markets is listed below.

LARGE CENTERS OF CATTLE SLAUGHTER AT CENTRAL CATTLE MARKETS

Average Number Slaughtered for the Ten-Year Period, 1930-1939¹

<i>Market</i>	<i>Average Yearly Slaughter, Thousand Head</i>
Chicago, Illinois	1071
Omaha, Nebraska	834
Kansas City, Missouri	544
South St. Paul, Minnesota	412
East St. Louis, Illinois	355
Sioux City, Iowa	335
Fort Worth, Texas	329
St. Joseph, Missouri	290
Jersey City, New Jersey	232
Oklahoma City, Oklahoma	230
Los Angeles, California	210
Cincinnati, Ohio	192
Milwaukee, Wisconsin	172
Indianapolis, Indiana	167
Detroit, Michigan	140

Four National Meat Packers

There are some names which have been landmarks in the meat packing industry. Philip D. Armour in 1863 started a meat packing enterprise in partnership with Plankinton at Milwaukee, and established Armour and Company at Chicago in 1867. Swift and Co. had its origin at Barnstable, Mass., where G. F. Swift, Sr., built a slaughter house. Later (1875) Mr. Swift moved to Chicago and founded a meat packing plant (1877), the beginning of Swift and Co.

We have four national packers. They are Armour and Company, the Cudahy Packing Company, Swift and Co., and Wilson and Company. Their combined slaughter comprised 54 per cent of the cattle, 59 per cent of the calves, 47 per cent of the hogs, and 74 per cent of sheep and lambs slaughtered in all wholesale slaughtering establishments in the United States during the five-year period 1934-1938.² Plants in which wholesale slaugh-

¹ Data from the Agricultural Marketing Service, U.S.D.A. Source, *The Drovers Journal Yearbook of Figures*.

² Knute Bjorka, *Trends in Livestock Slaughter*, B.A.E., U.S.D.A., September 1939.

tering is conducted include those operating under federal inspection and many that do not have such inspection. Most of the plants operated by these four national packers are under federal inspection.

The trends in the proportions of the livestock slaughtered in the plants of the four national concerns since 1920 have not been the same for the different species of livestock. For cattle, the trend has been downward, whereas for calves it has been upward during most of this period. The proportion of the total hog slaughter handled by these packers decreased from 1920 to 1925, then held about steady until 1932, but has since been increasing. Their slaughter of sheep and lambs increased in relation to the total from 1920 to 1928 but since that time it has remained fairly constant.

Central Markets as a Source of Slaughter Cattle

Most of the cattle and calves slaughtered by packing plants which have federal inspection are purchased at the public stockyards. For a five-year period, 1933-1937 inclusive, 73.9 per cent of the calves that were slaughtered under federal inspection came from the public stockyard markets, while 27.1 per cent were secured by the slaughters from other sources. For cattle older and heavier than calves the meat packers secured 81.9 per cent of those slaughtered under federal inspection from the central or public stockyard markets, while 18.1 per cent were purchased elsewhere.

Combining the groups, cattle and calves, 78.4 per cent were purchased on the central markets, while 21.6 per cent were purchased at places other than the central markets. The proportion of cattle moving from the farmer or local buyer direct to the meat packer using federal inspection has increased, but the growth of direct marketing has been much greater with hogs. Decentralization of meat packing has been greater in hog slaughter than with cattle slaughter, as the interior packers have made greater inroads into pork packing than cattle slaughter. Terminal markets have maintained their sales volume of cattle much better than hogs. Recent shortages of slaughter hogs owing to droughts and other causes have led some of the interior

packing plants to extend their operations in slaughtering more livestock other than hogs.

With the growth of slaughter by interior packing plants, the meat packers at the terminal markets established buying stations in the livestock producing areas. These are referred to as "concentration yards."

Seasonal Variation in Slaughter of Cattle and Calves

There is some seasonal variation in the slaughter of cattle and calves. See Figure 42. As the cattle receipts are larger in the fall months, the slaughter is slightly heavier at that time. However, the movement from the market as feeders and stockers

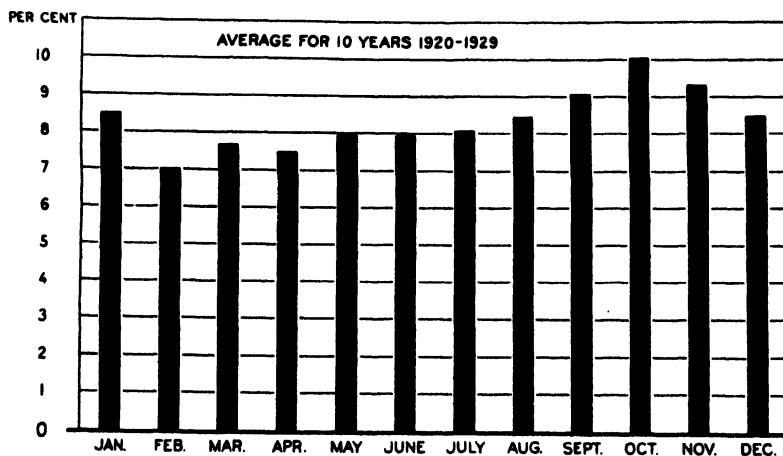


FIG. 42. Cattle slaughtered under federal inspection, by months. (U.S.D.A., Bur. of Agri. Economics.)

takes the greater portion of the increased receipts. Cattle slaughter is at a low ebb in February, March, and April, yet the pooled-cattle slaughter under federal inspection for a ten-year period, 1930-1939, for these three months is 22.4 per cent of the yearly slaughter, with a fairly even distribution for each of the months. August, September, and October are the heaviest three months in cattle slaughter, and for the ten-year period 27.87 per cent of the cattle were slaughtered in these months. About 47 per cent were slaughtered the first half of the year and 53 per cent the last half.

Calf slaughter is less variable than cattle in numbers. The spring months, March, April, and May, have the heaviest slaughter, while the winter months, December, January, and February, have the lowest slaughter.

*The Slaughtering Process*¹

The endless chain method of dressing, which is used in the dressing of hogs, calves, and sheep, is not adapted to cattle because of their size and other physical characteristics. In different plants the various steps in cattle dressing vary, but in general the process consists of the following steps: stunning, shackling, hoisting, sticking, bleeding, then lowering to the floor for skinning and completing the dressing while the carcass is being raised.

Prior to slaughter cattle are handled in such a way as to reduce bruises to a minimum. Overfeeding or starving are to be avoided. Experience has indicated that normal treatment in all respects yields best results in cattle dressing. Excessive activity or excitement apparently hinder complete bleeding on sticking.

STEPS IN DRESSING CATTLE

1. Cattle are driven into small pens for stunning. Electric prods are used at some plants. In any case heavy beating or prodding are reflected in the condition of the carcass. The stunning is done with a blow from a light sledge hammer on the forehead. The side lifts and the floor drops down from the knocking pen so the stunned animal is rolled out on the killing floor.

2. The animal is shackled, hoisted, then stuck and bled. Also while in this position the head is skinned and removed.

3. On lowering to the floor the shanks are skinned and removed at the knees and the hocks. The hide is then ripped along the median line on the belly and removed from the sides and belly. The breast bone is split by sawing on the center line.

4. Beef hooks are inserted on the gam cord, and the animal is partially raised to a position known as "half hoist." In this

¹ The Institute of American Meat Packers, *Readings in Packing House Practice*. Part II, *Beef, Mutton and Veal Operations*, 1925.

position the hide is removed from the shanks, rounds, and rump. The "fell" or elastic tissue known as "facia" is just under the hide and attached to the flesh or meat. In the removal of the hide the fell is left on the carcass. Extreme care must be taken not to cut or score the hide, as this affects its market value. The



FIG. 43. A view on a beef killing floor of a packing plant, showing the various steps in the slaughter of cattle. (Herman Kemper Sons, Cincinnati, Ohio.)

hide is pulled and beaten off in parts to make the proper separation.

5. The carcass is hoisted to an overhead track, where the hide and viscera are removed. The viscera and the carcass are then examined by a United States government inspector, if the plant is under federal inspection.

6. The carcass is then split and the tail removed. The split vertebrae in the back and loin are cut with a scribe saw on the dorsal part and pounded back to give a thicker appearance.

7. The carcass is washed next, then dried, and cloths are placed in the large blood vessels to prevent dripping.

8. It is common practice to shroud the better carcasses, that is, wrap them in a sheetlike cloth after washing so they will have a smoother appearance when unshrouded after chilling. Trimming is also an important step which affects the appearance of the carcass.

SLAUGHTER OF VEAL CALVES

Veal carcasses are usually sold as the entire carcass to the meat dealer and often as such they are sold with the hide on. In some plants the calves are skinned during the dressing process, and at some plants such carcasses are covered with a protective material such as knitted bags.

The advantage of leaving the hide on in the dressing and chilling is that it reduces water loss by evaporation, protects the carcass, and has a bleaching effect. Veal is higher in moisture than other meats.

The "endless chain" method of dressing, much like that used in dressing sheep, is used with veal calves. A wheel hoist is used to hoist the shackled calves to the rail. Sticking and bleeding follow, after which the next operation is washing. This process must be complete when the hide is not removed. Following this operation, the dressing proceeds much the same as that of cattle.

KOSHER SLAUGHTER

This method of slaughter differs from the usual procedure in that the cattle are not stunned. The throat is cut with a special type of knife, and the killing is performed by a rabbi of the Jewish church or a specially trained representative. Two objectives are in mind in the slaughtering method. They are instant death and a rapid, free flow of blood from the animal. There is also kosher inspection of the lungs while dressing, and finally the carcass is marked on the brisket with a cross inside a circle, date of slaughter, and the name of the inspector. The carcass is cut in the evening of the day the animal is slaughtered, and early the next day the wholesale cuts are in the retail shops. Usually beef is cut 36 to 48 hours after slaughter, but

kosher beef is broken up into wholesale cuts within 12 hours after slaughter. Rapid chilling for kosher beef is therefore imperative.

Average Live Weight and Dressing Percentage of Cattle and Calves

In a monthly survey of wholesale slaughters by the Agricultural Marketing Service, information is obtainable as to the average weight and dressing yield of livestock slaughtered in the United States. For the ten-year period 1930-1939 the range in weight (yearly averages) of cattle slaughtered was from 899 to 958 pounds, and the mean of the yearly averages was 933 pounds. The average dressing yield was 54 per cent. Feed conditions as well as the market situation influence the weight to which cattle are fed before they are marketed. When the ratio of feed prices to cattle prices is wide, that is, when feed prices are relatively low and cattle prices high, cattle are fed out to heavier weights.

For the same ten-year period veal calves slaughtered in the United States weighed 184 pounds with the yearly averages ranging from 174 to 191 pounds. Apparently heavier calves are being marketed than formerly because for the period 1934-1935 inclusive the yearly average has not been under 185 pounds. The average dressing yield for the ten-year period was 57 per cent on the basis of dressed with the hide on.

Dressing Percentage or Carcass Yield

Steers that are fat, trim middled, refined in the head, hide, and bone, and of the beef type will dress high. A high yield of carcass is desirable, for it usually sells on the wholesale market for twice as much as the purchase price per pound. The weight lost in dressing, which is the source of the by-products, is worth much less per pound than the carcass, some of it is valueless, and it also has a water loss upon processing. In cattle about 88 per cent of the income to the meat packer is from the carcass.

The better grades of beef steers have the highest carcass yield, while thin canner cows have low dressing yields. Shrink and fill prior to slaughter, of course, influence yields.

Following is the usually expected range in dressing various classes.¹

	<i>Dressing Percentage</i>
Good type show steers	59 to 63
Good to choice grade steers	56 to 59
Fat cows	54 to 58
Canners	35 to 43

Of the champions in the carcass competition for steers and heifers at the International Livestock Exposition² the highest dressing percentage was made by Bamboo H., an Aberdeen-Angus Senior Yearling steer shown by the Iowa State College that weighed on foot 1270 pounds and dressed 70 per cent. At the 1939 International the highest dressing carload was a group of 1054-pound Angus shown by Schmidt Bros., Delmar, Iowa, that dressed 67.2 per cent.

Federal Meat Inspection

Most of the meat entering into interstate and foreign shipment must be slaughtered under federal inspection. The meat inspection laws do not apply to farm slaughter and slaughter by retail butchers and dealers. However, they are required to furnish shippers' certificates to make interstate shipment. The retail butchers and dealers are also required to obtain certificates of exemption from inspection in order to ship meat and meat food products in interstate or foreign commerce. The inspection is maintained at establishments where cattle, sheep, swine, or goats are slaughtered or meat is processed for food purposes if the carcasses or meat products enter in whole or part interstate or foreign trade.

In the fiscal year ending June 30, 1939, inspection of livestock³ and meat products was conducted at 684 establishments located in 249 cities and towns. Following is a tabulation of the disposition of the cattle and calves.

¹ Adapted from E. N. Wentworth, *Progressive Beef Cattle Raising*, Armour and Co., 1920.

² Data from *Review and Album*, International Livestock Exposition, 1939, Chicago, Illinois.

³ J. R. Mohler, *Report of the Chief of the Bureau of Animal Industry*, 1939.

ANTEMORTEM AND POSTMORTEM INSPECTIONS
Fiscal Year 1939

<i>Kind of Animal</i>	<i>Antemortem Inspection</i>			<i>Postmortem Inspection</i>	
	<i>Passed</i>	<i>Suspected</i>	<i>Condemned</i>	<i>Passed</i>	<i>Condemned</i>
Cattle	9,449,813	91,425	3,064	9,486,009	55,229
Calves	5,368,419	7,208	2,851	5,336,490	17,015

The inspection prior to slaughter, or antemortem, results in three divisions: condemned, which are not passed for food; passed, which means that these are merely passed on the one examination; and suspected, which is used for animals suspected of being affected with disease or conditions that may cause condemnation in whole or part on special postmortem examination. Of the livestock passed in the antemortem examination the majority are passed for food when inspected during slaughter. Some carcasses or parts of carcasses are condemned or considered not fit for human consumption. The greatest cause of condemnation on foot is moribund which includes animals found dead in the pen at the time of inspection. Some calves are condemned for immaturity.

Following are listed in order of rank the common causes of condemnation of carcasses in cattle and calves.

1. Pneumonia, pleurisy, enteritis, peritonitis, etc.
2. Septicemia and pyremia.
3. Emaciation.
4. Immaturity (in calves).
5. Tumors, carcinomata, sarcomata, etc.
6. Tuberculosis.
7. Injuries.
8. Pseudoleukemia.
9. Actinomycosis.

In condemnation of parts actinomycosis, tumors and abscesses, tuberculosis, and injuries are the common causes.

Meat Defined

Flesh used as food is usually referred to as meat. It is the clean, sound, edible portion of striated muscle of an animal.

The official definition of meat of the U. S. Department of Agriculture is as follows:

Meat is the properly dressed flesh derived from cattle, from swine, from sheep, or from goats sufficiently mature and in good health at the time of slaughter, but is restricted to that part of the striated muscle which is skeletal or that which is found in the tongue, in the diaphragm, in the heart, or in the esophagus and does not include that found in the lips, in the snout or in the ears; with or without the accompanying and overlying fat and the portions of the bone, skin, sinew, nerve and blood vessels which normally accompany the flesh and which may not have been separated from it in the process of dressing it for sale.

It will be noted that this definition restricts the use of the word "meat" to that from cattle, swine, sheep, and goats. When used with reference to other animals it is to be prefixed by the kind of animal. For example, we may have horse meat, buffalo meat, etc.

Meat by-products also have an official definition. It is as follows:

Meat by-products are any clean, sound and properly dressed edible parts other than meat, which have been derived from one or more carcasses of cattle, swine, sheep or of goats sufficiently mature and in good health at the time of slaughter. Meat by-products from animals other than cattle, swine, sheep and goats must be designated by the proper prefix.

Disposition of Carcass Beef

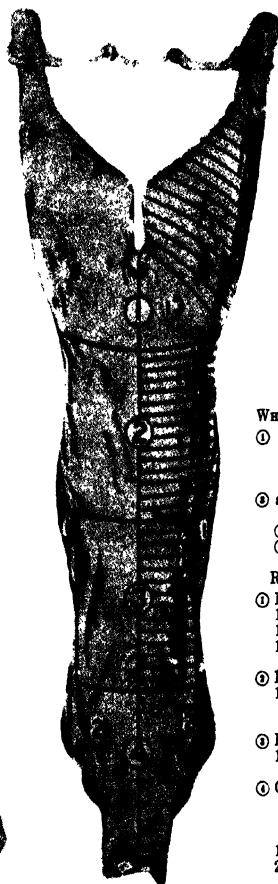
Beef carcasses may be divided into two groups:

1. Beef suitable for "block beef" or to be sold by the retailer "over the block." Such beef is purchased by the retailer in sides, quarters, or the wholesale cuts.
2. Beef unsuited for the retail trade as wholesale cuts is handled by the beef cutting department of a meat packing plant. This lean beef is boned and the beef is retailed as boneless cuts, canned, made into sausage, cured, or dried and smoked. There has been an increase in sausage production, which has caused increased demand for boneless cuts. About one-fifth of the cattle slaughtered are used for boneless beef and beef trimmings.

- ① Hind Shank
1 to 3 Soup Bones
4-Hock
- ② Round
1 to 14 Round Steaks
15-Heel of Round
- ③ Rump
Steaks or Roasts
- ④ Loin End
1 to 6 Sirloin Steaks
- ⑤ Short Loin
1 to 3 Club or Delmonico Steaks
4 to 11 Porterhouse Steaks
- ⑥ Flank
1-Flank Steak
2-Stews or Hamburger
- ⑦ Rib
1 to 4 Rib Roasts
5-Short Ribs
- ⑧ Trimmed Chuck
1 and 2 Bottom Chuck Roasts
3 and 4 Top Chuck Roasts
5 to 7 Chuck Rib Roasts
- ⑨ Neck
1-Boneless Roasts
Stews or Hamburger
- ⑩ Fore Shank
1 to 3 Soup Bones
4-Shoulder Clod
- ⑪ Brisket
1-Stews or Boned and Rolled Roasts
- ⑫ Plate
1-Stews or Boned and Rolled Roasts
2-Short Ribs



FIG. 44. Beef carcass, indicating the wholesale and retail cuts. (U.S. D.A., Cir. 300.)



WHOLESALE CUTS

- ① and ② Hind Saddle
- ③ Leg
- ④ Loin
- ⑤ and ⑥ Fore Saddle
- ⑦ Hotel Rack
- ⑧ Chuck

RETAIL CUTS

- ① Leg
1 to 12 Cutlets
13-Roast
14-Shank (Stew)
- ② Loin
1 to 15 Loin and Kidney Chops
- ③ Hotel Rack
1 to 14-Rib Chops
- ④ Chuck including Shoulder, Neck and Breast
1-Stew
2-Roasts

FIG. 45. Veal carcass indicating the wholesale and retail cuts. (U.S. D.A., Cir. 300.)

Numerals in circles ○ refer to wholesale cuts and major subdivisions of such cuts. Other numerals refer to retail cuts

WHOLESALE CUTS AND SUBDIVISIONS

ALL PERCENTAGES BASED ON CARCASS WEIGHT

① to ② Hindquarter.....	48.0%
③ to ④ Round and Rump.....	24.0
⑤ Hind Shank.....	4.0%
⑥ Buttock.....	15.0
⑦ Rump.....	5.0
⑧ & ⑨ Full Loin Inc. Suet.....	20.5
⑩ Loin End.....	7.0
⑪ Short Loin.....	10.5
⑫ Kidney Knob.....	3.0
⑬ Flank.....	3.5
⑭ to ⑮ Forequarter.....	52.0%
⑯ Rib.....	9.5
⑰ & ⑱ Chuck.....	22.0
⑲ Trimmed Chuck.....	17.0%
⑳ Neck.....	5.0
㉑ Fore Shank.....	5.5
㉒ Brisket.....	8.5
㉓ Plate.....	8.5

Numerals in circles ○ refer to wholesale cuts. Other numerals refer to retail cuts

YIELDS OF WHOLESALE CUTS AND SUBDIVISIONS

① and ② Hind Saddle.....	40%
③ Legs.....	40%
④ Loin.....	9%
⑤ and ⑥ Fore Saddle.....	51%
⑦ Hotel Rack.....	6.5%
⑧ Chuck.....	44.5%

Wholesale Cuts of Beef

Block beef is broken up into cuts desired by the meat retailers. Considerable beef is shipped and delivered to retail shops as sides and quarters. The wholesale or primal beef cuts are available to meat dealers, which permits greater flexibility of distribution. The hind quarter is separated from the front quarter between the twelfth and thirteenth ribs. One rib is left on the hind quarter. About 48 per cent of the carcass weight is in the hind quarter and 52 per cent in the front.

The wholesale cuts of beef are not the same on all markets. In the Chicago style of cutting, for example, the wholesale cut known as the rib has the seven last ribs on the front quarter, and the chuck five, while the New York style of standard wholesale cut of rib includes eight ribs, and the short chuck has but four. On the New York market a wholesale cut known as the "New York full chuck" may have seven, eight, or nine ribs. The beef cuts such as round and rump, loin, rib, and chuck are common on the markets for wholesale beef cuts, but these cuts differ on the various markets in size and shape.

The Chicago style of standard wholesale cuts is more completely discussed in this text. In Figure 44 is a diagram of the regular wholesale cuts of beef, also the retail cuts common to those parts.

Wholesale Cuts of Veal

The wholesale cuts of veal are usually fewer than for beef carcasses. Also, whole carcasses are used more in the trade than sides, quarters, or other wholesale cuts. Heavier veal carcasses are divided up more generally than the lighter weight carcasses. Splitting is not so common, and when the two quarters are sold unsplit they are called a "saddle"; for example, there is a hind saddle and fore saddle.

The common wholesale cuts of the veal carcass are shown in Figure 45.

BY-PRODUCTS FROM CATTLE AND CALF SLAUGHTER

The carcass is referred to as the primary product, and the other materials yielded from cattle and calf slaughter as the by-

products. Clemen¹ has defined a packing house by-product as everything of value produced on the killing floor other than dressed meat.

Packing house by-products include a host of materials. Some plants merely sell their raw slaughter by-products from the killing floor to other companies for manufacture into finished products. Other meat packing companies process the slaughter by-products rather completely and sell such finished products as soap, glue, etc. Some also manufacture products similar to packing house by-products like lard substitutes that are not derived from livestock slaughter.

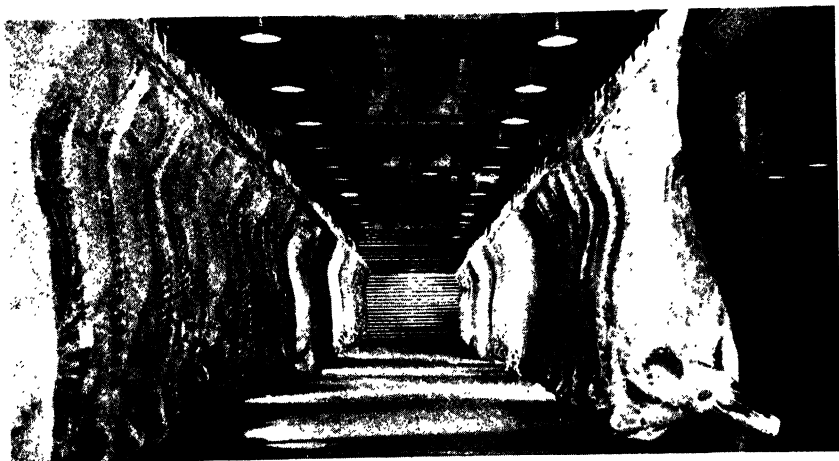


FIG. 46. Beef carcasses in the cooler. (Armour and Co.)

Returns from Slaughter By-Products

The returns from the sale of by-products from livestock slaughter are minor compared with the returns from the sale of the carcass. Clemen² has indicated that the probable return to the packers from the meat and by-products is as shown on p. 139.

Sheep rank first and hogs last in percentage of return from the slaughter by-products. Expressed another way and considering the hide value, sheep, cattle, and calves bring in considerable more return from slaughter by-products than hogs.

¹ Rudolf A. Clemen, *By-Products in the Packing Industry*, p. 9. University of Chicago Press, Chicago, 1927.

² Clemen, *op. cit.*, p. 9.

PROPORTION OF SLAUGHTER INCOME FROM MEAT,
BY-PRODUCTS, AND HIDE OR PELT

All Figures in Per Cents

<i>Kind of Livestock</i>	<i>Meat</i>	<i>By-products</i>	<i>Hide or Pelt</i>
Steer	87.3	4.1	8.6
Calf	92.8	7.2	Sold with carcass
Hog	96.6	3.4	Sold with carcass
Sheep	81.4	4.1	14.5

Although it may appear the by-product income is a minor item when the volume of slaughter is considered, this aggregate return is sizable. The complete recovery and utilization of the packing house by-products has long been one of the distinctive



FIG. 47. Final inspection of dressed beef by U. S. government inspectors.
(Swift and Co.)

features of the packing industry, yet with sheep this is less than 20 per cent and hogs less than 5 per cent of the slaughter income.

By-Products from Cattle Slaughter

GROUPS OF BY-PRODUCTS

The by-products are usually divided on the basis of edibility. Some of the edible by-products are meats and often confused with the principal product. Included in the edible offal are the heart, liver, and tongue, which are in the trade referred to as "meat specialties," or "fancy meats." The products not used for food are termed "inedible offal." When designated as "edible" all of the ingredients are clean, wholesome, and edible. If federally inspected the meat and meat products are from animals that have been inspected and passed as fit for food. Edible materials are suitable for human food, and the quality of the ingredients is acceptable as is also the manufacturing and handling.

YIELD OF VARIOUS PRODUCTS

The main by-products from cattle slaughter yield approximately as indicated below for an average steer.

WEIGHT (BY PER CENT) OF VARIOUS STEER PRODUCTS¹

	<i>Of Green Product</i>	<i>Of Finished Product to Live Steer</i>
Beef	55.6	54.3
By-products		
Hides	7.2	5.9
Fats	5.0	3.3
Head	3.4	2.2
Feet	1.5	1.1
Blood	3.8	0.7
Casings	1.2	0.8
Miscellaneous	5.4	...
Valueless materials	10.1	10.1
Shrinkage	6.8	6.8
Additional shrinkage through processing	...	11.6
	100.0	100.0

¹ Clemen, *op. cit.*, p. 10

It will be noted that of the by-products there is further shrinkage in processing so that of the 45 pounds of by-product yielded from 100 pounds of live animal 18.4 pounds is shrinkage or weight loss. Likewise 10.1 pounds of valueless material is yielded. The salable by-products from 100 pounds of slaughter animal weigh 17.2 pounds. Thus a 1000-pound steer would yield 172 pounds of by-products.



FIG. 48. Converting sides of beef into the wholesale cuts desired by the retail dealers. (Swift and Co.)

DISPOSITION OF BY-PRODUCTS BY A LARGE PACKING COMPANY

Swift and Company have listed the principal by-products of cattle slaughter, those finished by them, and the by-products manufactured after leaving their plants.¹

¹Swift and Company, *Agricultural Research Bulletin No. 6*, February 1936.

<i>Principal By-Products Obtained from a Steer</i>		<i>Finished By-Products Prepared by Swift & Company</i>	<i>By-Products Manu- factured after Leaving Swift & Company</i>
Hide	Cured Hide		Sole and Upper Leather
	Tail Hair		Harness Saddlery
	Body Hair		Raw Hide
	Ear Hair		Belting, etc.
	Hide Trimmings	Glue	Upholstering
	Hide Fat	Tankage—Fertilizer Tallow*	Curled Hair Brushes Felting Plaster Retardent Artists Brushes
Fats	Oleo Fat Edible	Oleo Stock	Oleo Oil {Bakery Trade Oleomargarine Cremol Confectionery Oleo Stearine {Lard Compounds Oleomargarine
		Tallow	Residue—Tallow
		Tankage	Animal Feed Poultry Food Fertilizer
		Soap Tallow	Soaps Glycerine Leather Dressing
	Tallow Fat Inedible	Tallow Oil	Lubricants Leather Dressing Textile Finishing
		Tallow	
		Tallow Stearine	Soaps Glycerine Leather Dressing
		Cracklings—Meat Scraps	
	Tankage	Animal Feed	
		Poultry Feed Fertilizer	
Head	Bones {Jaws Skulls }	Tallow*	
		Glue	
		Cracklings—Animal Feed	
		Bone Tankage—Steam Bone Meal	
	Horns {Horn Pith Horns }	Raw Bone Meal	
		Case Hardening Bone	
		Glue	
		Tankage—Fertilizer	
	Brains	Fertilizer	Buttons, Combs, etc.
		To Trade	
		Potted Meats	
		To Trade	
	Tongues	Sausage	
		To Trade	
	Head and Cheek Meat	Sausage	
		To Trade	
	Ox Lips	Sausage	
		To Trade	
	Ox Palates	Tankage—Animal Feed	
		Stick—Concentrated Tankage	

*Principal By-Products
Obtained from a Steer*

*Finished By-Products
Prepared by Swift & Company*

*By-Products Manu-
factured after Leaving
Swift & Company*

Feet	Dew Claws	Tallow*	
		Glue	
		Tankage—Fertilizer	
	Sinews	Glue	
		Stick—Concentrated Tankage	
		Cracklings—Animal Feed	
		Bone	Raw Bone Meal
			Poultry Bone Meal
			Steam Bone
		Tallow*	
			Bone Articles
			Buttons
			Knife Handles, etc.
	Bones	Neatsfoot Oil	
		Glue	
		Tankage—Animal Feed	
		Osseine—Gelatine	
		Case Hardening Bone	
			Ice Cream
			Candy
	Hoofs	Hoof Meal—Fertilizer	
			Package Gelatine
			Combs
			Novelties
			Buttons, etc.
Blood			
		Fresh	Sausage
			Albumin
			Serum
			Blood Flour
			Blood Meal
			Plaster Retardent
			Animal Feed
			Textile Sizing
			Weatherproof Glue
			Pharmaceutical Uses
Casings	Weasand	Casings	Sausage Lard and
	Bladder		Cheese Containers
	Intestines		
		Tallow*	
		Tankage—Animal Feed	
	Heart	To Trade	
	Liver	Sausage	
		To Trade	
	Sweet-breads	To Trade	
		Sausage	
		To Trade	
		Sausage	
	Hanging Tenderloin	To Trade	
		Sausage	
	Tail	To Trade (Ox Tails)	
Misc'l.	Kidneys	To Trade	
		To Trade	
	Tripe	To Trade	
		Sausage	
		Thyroid	
		Pineal	
		Para-	
	Glands	Thyroid	
		Pancreas	
		Pituitary	
		Suparenal	
		Gall	
			Pharmaceutical Uses
			</

BY-PRODUCTS VALUE EQUAL TO PROCESSING COST

In a comparison of the prices of live cattle and beef carcasses of comparable grade, it will be noted that the wholesale value of the carcass is about equal to the cost of the animal on foot. The returns to the packer from the sale of the by-products will cover the operating market expense and profit. The beef steer



FIG. 49. Meat Products in the refrigerated room being prepared for shipment. (Swift and Co.)

then will bring on the market about what the carcass will return to the slaughterer. A direct relationship exists between wholesale price of meats and cattle prices.

By-products vary in price. At times they may be worth more than the cost of slaughtering and dressing the beef animal. A comparison of prices paid for cattle and prices received for beef is made in the *Reference Book of the Meat Packing Industry*.¹

This is on the basis of the average yearly prices of cattle at

¹ American Meat Institute, Chicago, Ill., 1941.

Chicago and average yearly prices on the New York wholesale market.

CATTLE PRICES AND WHOLESALE BEEF PRICE COMPARED
U.S.D.A. Data

	1930	1931	1932	1933	1934	1935	1936
Received for beef*	\$10.53	\$8.12	\$7.02	\$5.24	\$6.66	\$9.55	\$7.99
Paid for cattle†	12.00	8.98	7.38	5.88	7.06	10.93	9.17

* For 58 pounds of beef.

† Good grade steers, 900-1000 pounds, per 100 pounds.

Two factors affect the relation between livestock prices and meat prices: the cost of processing and the value of the by-products. A lowered return for by-products may be an important factor in decreasing livestock prices.¹

Two of the by-products from cattle, hides and fats, merit further discussion because of their value.

CATTLE AND CALF HIDES

Hides are the most valuable of the cattle by-products. With heavy steers of high quality the hide usually is 9 per cent of the total value of the live steer. The hides of low-grade cows, which have a lower carcass yield and a carcass of lower value, may be worth 15 per cent of the total value. As calf hides are of high value because they are used for the highest quality leather, they comprise 20 per cent of the value of the calf on foot.²

Some of the factors related to the price of hides are the place of removal (packer or country), age, sex, and weight of the cattle from which they are derived, the presence of brands, and the method of cure. Hides are sold by weight usually, and the heavier hides are more desirable. Packer hides, because they are uniformly removed, properly handled and graded, and available in larger lots, bring higher prices than country hides.

Hides from cattle infested with ox-warbles may be of lower value because of grubholes. These are more prevalent in the

¹ "The Current By-Product Situation," *Monthly Letter to Animal Husbandmen*, Armour Livestock Bur., Vol. 12, No. 12, March 1932.

² "Hides and Leather as Cattle By-Products," *Monthly Letter to Animal Husbandmen*, Armour and Co., Vol. 15, No. 4, January, March, 1937.

spring of the year. If five or more grubholes are in the hide, the hides are discounted one cent per pound. This grubbing privilege of the buyer is from November 1 to May 31. Hides soiled with manure or other dirt are also reduced in price as are the hides from kosher-killed cattle (because of the large throat cut). Cut, scored, or damaged hides are likewise sold at lower prices.

Some of the important classes of cattle hides were of the following average price at Chicago for 1939.¹

	<i>Packer Hides</i>	<i>Country Hides</i>
Steers		
Heavy native	\$12.13	\$ 9.13
Heavy Texas	12.02	
Light Texas	11.12	
Bull branded	12.03	
Colorados	11.60	
Cows		
Heavy native	11.63	8.70
Light native	12.06	
Branded	11.55	
Bulls		
Native	8.64	6.76
Branded	7.64	
Calf Skins No. 1		18.51
Kip Skins No. 1		14.80

HIDE PRICE HISTORY AND SEASONAL VARIATION²

The trend of hide prices was moderately upwards from the beginning of this century to the outbreak of the First World War. Inflation and deflation following the war caused violent fluctuations in hide prices. Seasonal variation occurs mainly because of seasonal variation in quality. From December to April hide prices decline as winter yielded hides are of lower quality because of long hair, dirt, and grubholes. From April to November hide prices move upwards, in spite of greater supplies because of improved quality.

Hides and skins are of three kinds: (1) hides from mature animals, (2) kips, skins from immature or undersized animals, which range from 15 to 25 pounds cured weight, (3) calf skins, from young calves, which weigh 15 pounds. The difference in

¹ *Livestock, Meat and Wool Market Statistics and Related Data, 1939, U.S.D.A. Agr. Marketing Service, May 1940.*

² "Hide Prices, the Tariff and Marketing Methods," *Monthly Letter to Animal Husbandmen*, Armour and Co., Vol. 7, No. 5, August 1926.

price for the various grades is due to the quantity of a grade available and the requirement of consumers.

BEEF FATS

The various fat products which arise from the processing of beef fats have been indicated previously. This processing involves refining, bleaching, and deodorizing. A finished product results that may be either edible or nonedible. One of the prominent products from beef fat is oleomargarine. In the manufacture of oleomargarine in 1930, vegetable oils constituted 52.46 per cent of the materials used and animal fats 17.67 per cent. Of the total materials used oleo oil was 10.67 per cent, neutral lard 4.62 per cent, and oleo-stearine 1.48 per cent.¹ The oleo oil and stearine are prominent fat by-products from cattle.

PROFITS TO MEAT PACKERS

The net return to packing plants conducting slaughtering operations is relatively low. Meat packing is a highly competitive business. There is competition, first, in the buying of livestock, and second, in the sale of meats and meat products. More than a thousand meat packers in the United States compete with each other, as well as with local butchers, custom slaughtering, and home butchering, in providing consumers with meat. The extent of this competition is indicated by the distribution of slaughter. Of the aggregate number of animals dressed in 1936, farmers and local retailers dressed about 24 per cent. They accounted for 17 per cent of all of the cattle dressed, 26 per cent of the calves, 10 per cent of the sheep and lambs, and 31 per cent of the hogs.² Most of the packing operations are comparatively simple, and restrictive patents do not curtail competition in meat processing. Consequently new packers can easily enter the field. It is also imperative that the successful packer handle a large volume of product at a low cost per unit. That such is the case is indicated by a survey of data from the United States Department of Agriculture by the Institute of Meat Packers.³ The net worth, sales, and profits of

¹ "Some Competitive Factors Affect Beef Fats," *Monthly Letter to Animal Husbandmen*, Armour and Co., Vol. 12, No. 11, February 1932.

² *The Livestock and Meat Industry*, Vol. IV, No. 1, Swift and Co.

³ "Packer Profits," *Agri. Res. Bul.* 16, Swift and Co., June 1939.

companies conducting slaughtering operations for the period 1925-1937 inclusive were averaged. The number of plants from which information was obtained was variable from year to year but ranged from 339 to 686.

The data indicated:

Return per dollar of sales	\$0.0091
Average profit per 100 pounds of livestock	0.12
Average profit per 100 pounds of dressed meat	0.19

The slaughtering of farm animals in modern meat packing plants under the factory system is highly efficient and therefore economical. Each worker has but one specialized step to perform in the process of dressing, and skill in performance of that duty is soon acquired. For the most part the carcasses are moved to the workers by conveyors, and the various steps are standardized so that the entire process is swift, efficient, and economical.

There is much cyclical fluctuation in the production of livestock, but as the cycles are not of the same duration it is seldom that low production in two kinds of livestock occurs at the same time. The volume of meat packing is relatively stable. Even though production of meat animals remains fairly uniform, profits to meat packers fluctuate rather violently. Profits are high when prices are high or rising and low when prices are falling.

Chapter 9

MARKET CLASSIFICATION OF DRESSED BEEF AND VEAL

CLASSIFICATION OF BEEF AND VEAL

To facilitate trade in dressed beef, the carcasses or wholesale cuts are divided into groups of similar characteristics. Within each group or lot there is a uniformity in the various features which are related to the market value of the beef. As no two carcasses are identical, the limits of each group are arbitrary, hence differences in grouping occur. The classes are the larger divisions, and these are subdivided into grades which include those units which sell at about the same price per pound. In some classes there are subclasses, which are the weight divisions. Although the carcasses or wholesale cuts are classed and graded the entire process is commonly referred to as "grading."

By the use of classes and grades, beef is divided into lots for trade which include carcasses, or wholesale cuts, of similar value. The class and grade convey to the prospective buyer rather definite qualifications. A market quotation of beef given for a specific class and grade has a definite meaning to one familiar with the terms of the trade. It can be readily seen that a buyer can purchase beef by class and grade, without inspection, and know approximately what he will receive.

Fresh Beef

The fresh beef entering into regular channels of trade is either "fresh chilled" or "fresh frozen." This refers to the general method of handling rather than to actual differences in the beef in regard to conformation, finish or quality. The fresh chilled beef is held at temperatures ranging from 34 to 38° F. for from 24 to 36 hours. Usually soon after it is chilled it is moved into the retail trade. Under ordinary refrigeration it may be "aged" from four to six weeks or longer. When so held changes take place in the meat, increasing the palatability. A recent

development is aging at higher temperatures with control of bacterial growth, which hastens the process.¹ Only the better grades are aged because finish is necessary to retain soundness during aging and consumers of the better grades are willing to pay for the increased palatability gained by aging.

Fresh frozen beef is subjected to a temperature of 5 or 10° F. and frozen solid. Such meat can be held for indefinite periods if kept frozen. The bulk of export beef is handled in this fashion. Consumers of beef in the United States prefer "fresh chilled" beef, and it has been estimated that 97 per cent of the fresh beef sold is so handled.

Basis for Grouping Carcasses

The main features which form the basis for grouping of market beef are quality, conformation, and finish. Only sound and wholesome beef is subject to grading. Diseased, bruised, or partially decomposed meat is "off grade." A definition and a brief description of each of these terms, adapted from U.S. Department of Agriculture *Bulletin 1246*, "Market Classes and Grades of Dressed Beef," follow.

QUALITY. Quality is a characteristic of the flesh and the fat included therein. It pertains primarily to the thickness, firmness, and strength of both the muscle fiber and the connective tissue. It also involves the amount, consistency, and character of the juice or extractives which surround and permeate the muscle fiber and connective tissue. It is strongly influenced by marbling. Color does not determine quality; however, it, like finish, serves as an excellent index to quality.

The best quality in beef implies: full, well-developed, firm muscular tissue or flesh with a minimum of strength in fiber and connective tissue. Beef of this sort possesses a high proportion of juice to dry fiber, but this moisture must be of such consistency that the flesh when chilled remains firm and resilient. There must also be liberal deposits of fat between the muscle fibers, giving the cut surface a streaked or marbled appearance. This fat, together with the juice or extractives, gives the meat juiciness and flavor. The cut surface of beef of this sort has fine grain, and is smooth and

¹ The "Tenderay Process" developed by M. D. Coulter at the Mellon Institute of Industrial Research is used to age beef in two or three days. The beef is held at a temperature of 60° F. and humidity of 90 per cent in the presence of sterilamps, which inhibit mold and bacterial growth. *Annual Meat Packers Guide*, 1940. Davis Publications, Chicago.

velvety to sight and touch. The color is a light or cherry red.¹ The cut surface also presents a sheen or reflection not apparent in beef of poorer quality. This is due to the fine grain of the meat, the consistency of the juice, and the oil of the fat giving a smooth surface which reflects light much better than the relatively dry, or watery, coarse fiber of poorer quality beef.

Poor quality in beef involves the opposite of most of the good characteristics. Such beef is usually of dark red color, because the muscle has been subjected to prolonged, vigorous exercise and has therefore had a relatively large blood supply. For the same reasons the muscles are made up of strong, tough fibers, and the connective tissues are comparatively thick and tendinous. The amount of juice is small or it is thin and watery. There is no marbling. As a result the meat is stringy, tough, and inferior in flavor. The ratio of muscle to connective tissue is relatively low, as is also the ratio of flesh to bone. The grain is coarse, and the general appearance is watery or fibrous.

The quality of beef depends on a number of factors, of which breeding and feed are among the most important. Sex and age likewise have an important bearing on the quality of beef.

Quality determines the palatability of the meat and the ease with which it can be prepared for human consumption. Quality is the most important factor in determining grade of beef.

DETERMINATION OF QUALITY IN BEEF. Quality is rather difficult to determine as it pertains chiefly to the inner or concealed parts of the carcass, examination of which requires more than superficial inspection.

To determine quality with exactness it is necessary to have a cut surface, or cross section, exposed to view. There is such close relationship between conformation, finish, and quality that the beef grader can nearly always depend on a high degree of quality where the degree of the other two factors is high.

Quality is indicated to the beef grader by the color, texture, grain, and degree of marbling of the beef and also by the color and character of the chine and breast bone, as well as the age and origin of the cattle considered.

CONFORMATION. The term "conformation" covers the general build, form, shape, contour or outline of carcass, side, or cut.

¹ The problem of dark cutting beef is being studied by the National Livestock and Meat Board. In three years 1172 club calf carcasses have been studied and the dark cutters have been successively less each year. For the years 1938-1940 about 1.3 per cent of the calves in the junior livestock feeding show of the International have been dark cutters. Low muscle sugar and high Ph (low acid) was characterized in the dark cutter. Observation indicates inadequate feeding and exposure to cold weather may be a contributing factor to dark cutting beef. *Eighteenth Annual Report*, National Livestock and Meat Board.

The best conformation involves short shanks and necks, deep plump rounds, thick full loins, well-fleshed ribs, and a thickness of flank commensurate with the depth of barrel and chest cavity. Carcasses with poor conformation are typified by angularity in general outline, prominent hip and shoulder bones, long thin necks, shanks, and rounds, shallow loins, and a decided lack of symmetry in the carcass or side.

The conformation or form is dependent on the skeleton, the depth of flesh and the thickness and distribution of external fat. Conformation is largely a matter of breeding, although feed and care have an important influence. Conformation has much to do with determining the relative attractiveness of the carcass or side. Its chief significance lies in the fact that it indicates the ratio between meat and bone, also the ratio between the more desirable and higher priced cuts, such as rounds and loins, and the so-called coarser or low-priced cuts, such as chucks and plates.

FINISH. The finish refers to the amount, color, character, and distribution of exterior, interior, intermuscular, and intramuscular fat.

The best finish implies a smooth, even covering of brittle, flaky, white fat over most of the exterior surface of the carcass, averaging not more than three-fourths inch thick over the top of the loin and ribs, and an even, though much thinner, covering of flaky white fat on the interior surface of the ribs; also heavy, but not excessively "bunchy" or wasty deposits of white fat over the kidneys, in the crotch, and in the chest cavity. It also involves relatively heavy deposits of fat between the larger muscles, and a liberal distribution of fat along the connective tissues and between the muscle fibers. This latter characteristic gives the cut surface a streaked appearance and is known as *marbling*. With a highly finished carcass there is a projection of fat out between the split chine bones, a liberal "overflow" of fat over the middle of the ribs, and a marked intermingling of fat with the lean (feathering) between the ribs. The rounds, shanks, neck, and belly are the last portions of the anatomy to be covered with fat; hence, generally speaking, and with due regard for the maximum depth over the hips, loins, and rumps, the more extensive the distribution of fat over these surfaces the higher the finish.

OTHER FACTORS

Many other factors are involved in grading beef, and consequently many other terms are used in describing and differentiating the various grades. These are all merely subdivisions of the three factors already named and described.

Age, for example, frequently has much to do with indicating the grade of a carcass, but age in itself has no bearing on grade, except as it affects conformation, finish, and quality. In the same manner fat is always considered in grading meat, but fat is one of the elements which go to make up quality and finish, and naturally contributes to conformation. The same is true of such secondary factors as color, grain, marbling, and thickness of flesh. All are either included as factors under one or another of the three main characteristics just described and serve merely as indexes of conformation, quality, or finish.

Male and Female Beef Carcasses Compared

Male carcasses may be distinguished from female carcasses by the following characteristics:

1. Larger size.
2. Presence of cod fat in steers and stags, and also the absence of an udder.
3. Plump, heavy rounds and loins.
4. Heavier, more muscular shoulders.
5. Shorter, thicker necks.
6. Larger, heavier bones and knee joints.
7. Larger proportion of lean meat to total weight.
8. Less fat, especially in the kidney knob and on the rump.
9. Tendinous ring near the posterior point of the aitch or pelvic bone.
10. Less distance between the aitch bone and the tail-root and less distance between the posterior tips of the aitch bone.

In carcasses from very young cattle there is little or no difference between the sexes; in fact, it is not until the approach of maturity that the sex distinction becomes manifest in the various features of the carcass.

Age Groups of Beef Carcasses

There are four groups of beef carcasses based upon age. These are:

1. Mature beef.
2. Yearling beef.
3. Calf beef.
4. Veal.

There is no sharp line of distinction between the groups; in fact, the first two are commonly not separated. The groups have fairly distinctive characteristics in the middle of each range, but borderline cases exist and the transition of veal to calf, calf to yearling, yearling to mature beef is not too clearly defined.

Determination of Age in the Carcass

The age of the animal yielding the carcass may be approximated from the color and flintiness of the bones. Bones of younger cattle are softer, more porous, and more red in color, whereas bones of older cattle are flinty and white. In younger cattle there is more cartilage and less bone. On the carcasses of young beeves, small buttonlike cartilages on the dorsal part of the vertebra are evident when the carcass is split.

MARKET CLASSES AND GRADES OF DRESSED BEEF AND VEAL

A discussion of the market classes and grades of each group follows, along with a somewhat detailed description of each group.

Groups of Beef Carcasses and Cuts

The groups by sexes of beef are steer, heifer, cow, bull, and stag. Actually in the carcass no sex distinction is made in beef grading as was formerly done except that carcasses from bulls and stags are separated out, and the remainder go as beef. Steer carcasses because of their superior properties are placed in higher grades and cow carcasses go in lower grades.

THE SEX GROUPS OF BEEF DESCRIBED

STEER BEEF. In addition to having the characteristics typical of the male, the cod fat identifies the steer carcass. The carcasses of steers are of higher quality than those of stags and bulls and are superior in conformation and finish.

HEIFER BEEF. Heifer beef ranks next to steer beef in quality, conformation, and finish. To qualify for this class the individual must be beyond the veal or calf stages, not far advanced in pregnancy, nor have produced a calf. The compact form, less prominent hips, less spread in the ribs and loin, and greater

curvature of the aitch bone and pelvic arch distinguish the heifer from the cow carcass. Also, the udder is removed from the cow carcass. In fatness there may be some difference in that there is usually less on the heifer carcass and it is more uniformly distributed.

COW BEEF. Cow beef ranks below steer or heifer beef in quality and finish but is superior to bull or stag beef in these considerations. However, in conformation, the cow carcasses are inferior to all other market classes. Females that have produced one or more calves or are heavy with calf at the time of slaughter are classed as cows. Angular conformation, flat loins, light rounds, prominent hips, arched ribs, and thin flesh typify the cow carcass. When fat, which is usually the case, the fat is uneven in distribution, of yellow tinge, and oily in appearance.

BULL AND STAG BEEF. A male bovine that has reached sexual maturity is the source of bull beef. Bull carcasses are of large size, heavily muscled, dark in color, and usually quite devoid of fat. Heavy front quarters and a short, thick, crested neck are typical of the bull carcass. The male carcass features are manifest, but there is no cod fat as in the steers, and the color is very dark red and may have a bluish cast. Most of this beef does not enter the fresh beef trade but is disposed of for sausage and dried beef.

Males castrated after reaching sexual maturity are termed stags and yield stag carcasses. There is within this class great variation, related to the range of age of castration. If castrated when young, the carcasses approximate steer or heifer carcasses in conformation, quality, and finish. However, if castration has been postponed until the secondary characteristics are well developed, the carcass is quite similar to that of the bull.

GRADING BEEF

It is quite obvious that all beef within a class is not the same in value. Further separation of the carcass classes is accomplished by using grades. There are seven standard grades of beef: prime, choice, good, commercial or medium, utility or plain, cutter, and canner. A numerical designation of these classes is as follows: No. A-1, No. 1, No. 2, No. 3, No. 4, No. 5, and No. 6.

BEEF GRADES DEFINED

All beef carcasses are graded together, that is those from steers, heifers and cows. Bull and stag carcasses, which make up but a small proportion of the beef sold, are classified separately. A description of the beef included in the different market grades is adapted from the Official United States Standards for Grades of Carcass Beef.¹

U. S. PRIME, OR No. A-1. Such beef represents the best results of beef cattle breeding, care, and feeding. Only beef from the highest types of beef cattle, that have been fed intensively on grain or other fattening and flesh-forming rations, is found in this grade. Cattle which produce this grade have unusually high dressing percentages and lack excessive amounts of wasty fat. The average dressing yield is about 60 per cent of the live weight. They are young, usually under 3 years of age. The carcasses are perfect in quality, conformation, thickness of flesh, finish, texture, grain, and tenderness. They generally weigh between 500 and 700 pounds and not infrequently more. The number of such carcasses from all classes on the market, during the year, is very small, probably under 0.1 per cent of the total annual supply of carcass beef, excluding cutter and canner grades. They are in evidence in limited numbers, especially following the National and International Livestock Shows and during Christmas holidays. They are the "exhibits" of the beef trade, and are derived almost entirely from cattle that have been prepared for show purposes. The grade is composed principally of steers. There are a few Prime heifer carcasses, but no Prime cow, bull, or stag carcasses.

U. S. CHOICE. Beef so graded closely resembles Prime in nearly every respect. It generally is slightly deficient in quality and in finish. The fat may be slightly excessive or wasty, or it may be less than required for the Prime grade. Carcasses in this grade usually are from young animals of superior beef breeding, under 3 years of age, that have been fed intensively, but possibly not to the degree of those producing prime beef. Such carcasses are blocky, thick, smooth, and far above the average. Beef of this grade is more plentiful in winter and spring, but is available in limited quantities throughout the year. Steer carcasses predominate. The grade also contains a small percentage of heifer beef.

U. S. GOOD. This grade includes a larger number of carcasses than prime or choice. Good beef is above the average in quality, conformation, and finish. It admits a wider range in age than do

¹ "Official United States Standards for Grades of Carcass Beef," U.S.D.A. Service and Regulatory Announcement No. 99, June 1926. Amendment No. 1, July 1939.

the higher grades. The carcasses are blocky, thick, smooth, and well covered, usually showing some beef-type breeding, care in handling, and a moderate amount of intensive feeding on grain or concentrates. Such beef may meet most of the requirements of choice beef but be too fat and wasty to rank in that grade, or it may lack the necessary finish.

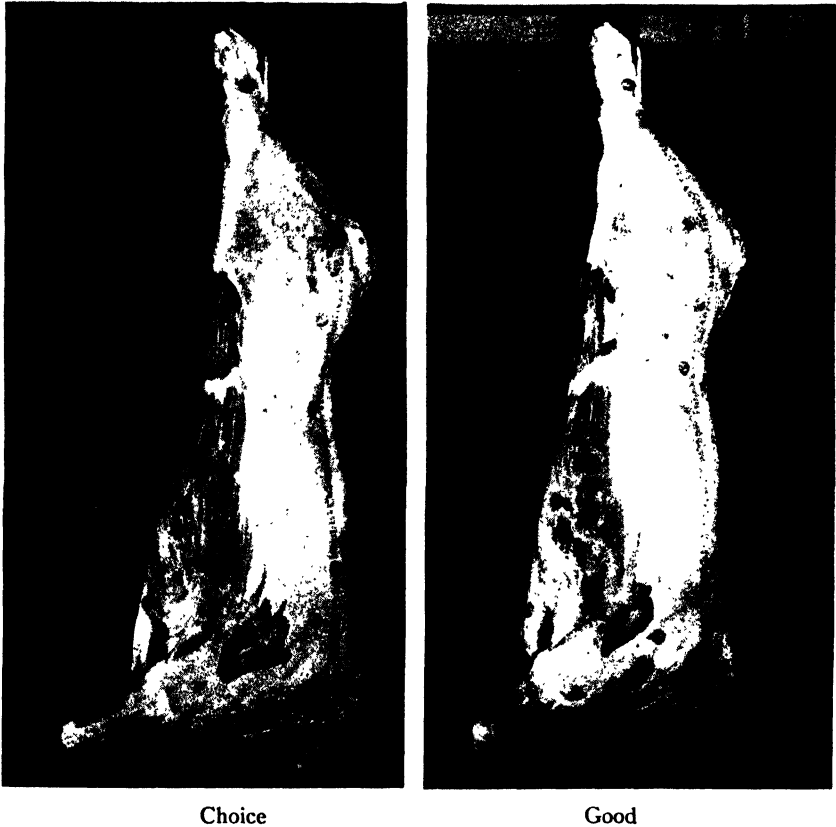
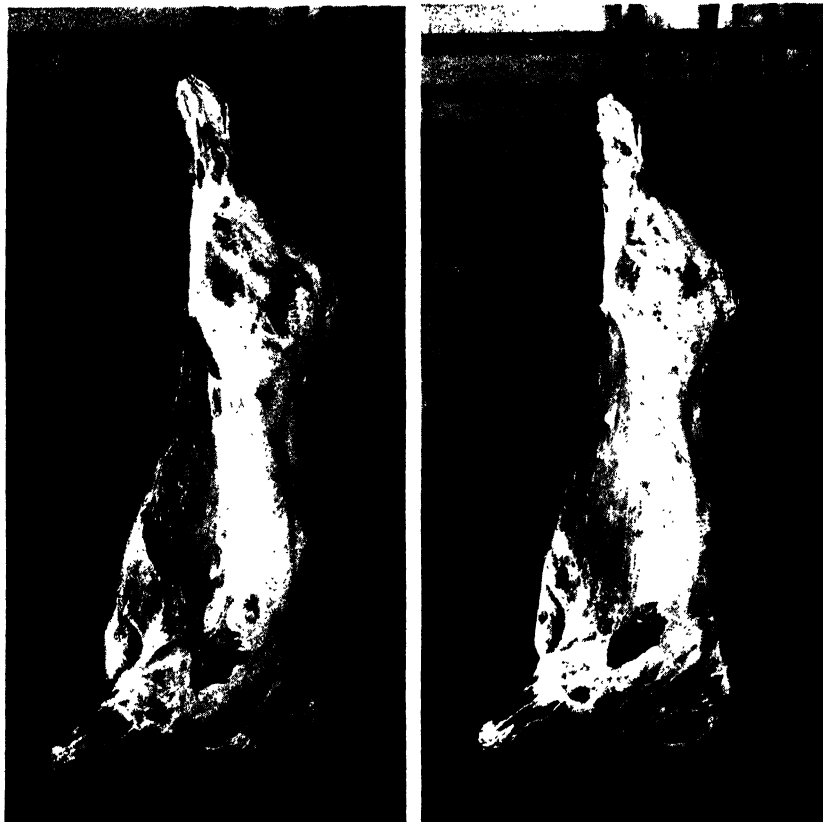


FIG. 50. Stamped sides of beef representative of Grades A and B. The grade appears on all the principal wholesale cuts. (U.S.D.A., Agricultural Marketing Service.)

A small percentage of beef derived from superior types of beef cattle fattened on grass and feeds other than grain and concentrates also appears in this grade. This grade is the lowest that shows any appreciable amount of marbling. Good carcasses are found on the market throughout the year, but are more plentiful in winter and spring. Carcasses from steers, heifers, and relatively young well-finished beef type cows may qualify for this grade.

U. S. COMMERCIAL OR MEDIUM GRADE. The commercial grade represents the average of beef carcasses. More than 50 per cent of all carcasses marketed annually fall within this grade. They are neither superior nor strikingly deficient in quality, conformation, or finish. The frames are slightly angular, the bones relatively prominent, and the flesh of average thickness. The fat, while in



Commercial

Utility

FIG. 51. Stamped sides of beef. (U.S.D.A., Agricultural Marketing Service.)

evidence and fairly well distributed, is not plentiful, except in fat cow carcasses.

Carcasses of this grade are in good supply throughout the year, but are more abundant in the summer and fall, when the better grades are relatively scarce. Beef produced from steers, heifers, and cows are in this grade.

U. S. UTILITY OR PLAIN GRADE. This beef is usually derived from poorly fed animals, scrubs, dairy, and thin range cattle. It

is very deficient in quality, conformation, and finish, and generally shows advanced age. Carcasses are angular in shape, the bones are very prominent and generally white and flinty. The fat covering and the interior fats are yellowish, very scarce, and of poor quality. Often the exterior fat is so thin as to give the carcass a dark or bluish appearance. The flesh is usually tough and very shallow in all parts. Plain is the lowest grade of beef offered regularly to the trade in carcass form under normal trade conditions. The entire carcass of a lower grade is not suitable for the butcher's block, and many plain carcasses are used for cutter and canner purposes. Plain grade beef is usually in evidence throughout the year, but is more abundant in the summer and fall. Cows contribute most to this grade, with steers and heifers ranking in the order named. This grade represents about 20 per cent of the total annual supply of carcass beef.

U. S. CUTTER GRADE. Beef of this grade is so deficient in form, finish, and quality that it is rarely marketed in carcass form, except in seasons of scarcity. The word "cutter" is a trade term, and refers to the manner in which such carcasses are marketed — generally in cuts. Usually only the ribs and loins of such carcasses will be accepted by the retail fresh meat trade. Cutter carcasses, as a rule, lack fat covering, except for a thin coat over the back. The flesh is too thin, except in the ribs and loins, to make satisfactory cuts. Carcasses of this grade are therefore usually boned out for the boneless meat trade, and for curing, sausage, and canning purposes. The rounds often are converted into dried beef hams. Cows contribute most to this grade, which includes very little beef from the other classes. Carcasses thrown out of any grade because of extensive bruises often are referred to as "cutters," because they are never sold in side or quarters, but are sent to the cutting departments, where the sound parts are converted into commercial cuts. When thus treated, the cuts fall in the grade to which they belong on the basis of quality, conformation, and finish. "Cutter" in this sense has no reference to the cutter grade.

U. S. CANNER GRADE. This grade is the lowest form of beef that is offered for human food. Carcasses that are unfit, in whole or in part, for the butcher's block come within this grade. They are often in such poor condition as to appear to be from animals suffering from anemia. This is especially true of old, worn-out dairy cows. The grade is composed very largely of beef from this class of livestock, and of starved or emaciated animals from other classes. Practically all carcasses of this grade are boned out. The meat is used chiefly for canning and sausage. A small percentage of boneless strips and cured beef is also obtained from this grade. Mature cows of advanced age predominate in this group.

STANDARD CLASSES AND GRADES OF WHOLESALE CUTS
OF BEEF

As considerable beef is wholesaled in the form of cuts such as loins, ribs, rounds, chucks, plates, flanks, and shanks, rather than as sides or quarters, classes and grades are also used for these cuts. These divisions are not as well defined as those of the carcasses, and much confusion exists relative to their use. Commonly, in market quotations, the cuts are of three grades, No. 1, No. 2, and No. 3, and the class coincides with the sex class of the live animal or whole carcass. Quotations are given for such as No. 1 — Steer Loins, No. 2 — Heifer Ribs, No. 3 — Cow Rounds, etc.

Standard grades have been set up by the U. S. Department of Agriculture similar to the carcass grades and using the same terms: prime, choice, good, commercial or medium, and utility or common, for the different cuts. It is possible to grade the wholesale cuts more accurately than the entire carcass because the cutting exposes a fairly large surface. Low cutters are not broken up into the wholesale cuts, and the low grades of bull and stag beef are not usually sold over the butcher block.

YEARLING BEEF CARCASSES AND CUTS

The carcasses of steers or heifers may be subclassed as yearling beef or "*baby beef*"¹ when lacking in maturity of mature beef and when more mature than calf beef or veal. Yearling beef is of lower finish or fatness, less marbled, less firm, lighter red, and also softer and smoother in texture than mature beef. Also in form the yearling carcass is less thick, and the bones are less flinty. Yearling beef carcasses are not as heavy as mature beef.

There is a variation in the age of yearling beef, but it usually comes from cattle ranging between 8 and 15 months of age. In growth, the beef animal passes through the different stages in which, if slaughtered, it would yield veal, calf beef, yearling beef, and mature beef. The changes are not the same in all

¹ Some confusion exists concerning the use of the term "*baby beef*." In the meat trade it is often used for lightweight beef, whereas the producers and feeders commonly refer to well-bred, fairly matured, well-fattened cattle between 8 and 20 months of age as baby beef.

individuals. However, usually up to three months of age they will yield veal carcasses, and from then to six months, a calf carcass is produced.

CARCASS GRADES AND FATNESS. The higher grades of carcasses are fatter than those of lower grades. The relationship of finish to grade is illustrated from the following data on the average physical composition of various grades of steer carcasses. This study, made by the U. S. Department of Agriculture, covered data from 71 cattle of the final feed lot weight of 557 to 941 pounds.¹

AVERAGE PHYSICAL COMPOSITION OF BEEF STEER CARCASSES

	<i>Choice</i>	<i>Good</i>	<i>Commercial (medium)</i>	<i>Utility (common)</i>
Average final feed lot weight	879	880	903	793
Average chilled carcass weight	523	512	520	436
Percentage of carcass in				
Separable fat	31	24	20	15
Separable lean	53	57	59	64
Edible portion	84	82	80	79
Bone, ligament, and tendon	16	18	20	21

The separable fat is that which can be dissected out, and this is determined by physical separation rather than chemical analysis. It will be noted that as the grade is decreased, the fat is lessened, the lean increased, the edible portion decreased, and the bone ligament and tendon increased.

PROPORTION IN VARIOUS CLASSES AND GRADES OF BEEF. The proportion of slaughter cattle in the various classes is influenced by the current cattle situation and the feed supply. When cattle numbers on farms and ranches are increasing, female stock makes up a smaller proportion of the total receipts of market cattle. Likewise when numbers are decreasing there is liquidation of breeding stock resulting in a large proportion of female stock in the total receipts.

Beef steers on foot over a period of years are graded about 20 per cent prime and choice, 45 per cent good, 26 per cent medium, and 8 per cent common. Steers make up about

¹ O. G. Hankins and M. T. Foster, "Approximate Physical Composition of the Primary Cuts from Steer Carcasses of Different Market Grades," U.S.D.A. *Pamphlet*, April 1940.

45 per cent of the receipts of slaughter cattle, heifers 15 per cent, cows about 40 per cent. Bulls and stags make up but a very small proportion of the slaughter cattle.

GROUPS OF CALF CARCASSES AND CUTS¹

Calf carcasses are from individuals older than veal calves (3 months) and younger than yearling beef (8 to 10 months). They come chiefly from the western range and are sometimes called "grass veal." The calf carcass is larger than that of the vealer. It is also coarser in texture and darker in color of the flesh. The fat is greater in amount, white in color, and firmer. The fat color is partially dependent upon the ration.

CALF CARCASSES. The receipts of calves are confined principally to the fall of the year, but range from June to November. The source is mainly from the beef producing areas of the western range, but a few are marketed from the corn belt.

The veal characteristics of the flesh begin to disappear at 12 to 14 weeks of age, and gradually as age advances the carcass assumes properties typical of beef. Compared to veal, the calf carcass is larger; the usual range in weight with the skin off is from 100 to 350 pounds, with by far the greatest number occurring in the last 150 pounds of the range.

A complete outline of the commonly used classes and grades of calf carcasses follows:

<i>Class</i>	<i>Weight Division *</i>	<i>Grade</i>
Steers Heifers Bulls	1. Lightweight — 110 pounds down.	1. Good or No. 2 2. Medium or No. 3 3. Common or No. 4 4. Cull or No. 5
	2. Medium-weight — 110 to 165 pounds	1. Choice or No. 1 2. Good or No. 2 3. Medium or No. 3 4. Common or No. 4 5. Cull or No. 5
	3. Heavyweight — 165 pounds up	1. Choice or No. 1 2. Good or No. 2 3. Medium or No. 3 4. Common or No. 4

* These weights are with "skin off" and should be increased by 10 per cent to include the skin, in which condition most young calves are sold. Older calves and heavier calves are sold with the skin off.

¹ W. E. Davis and C. M. Harris, "Market Classes and Grades of Dressed Veal and Calf Carcasses," *Circ.* 103, U.S.D.A., 1930.

The grading is based upon the evaluation of quality, conformation and finish.

WHOLESALE CUTS OF CALF CARCASSES. The wholesale cuts of the calf carcasses are similar to veal, and five grades—prime, choice, good, medium, and common—may be applied to the cuts.

GROUPS OF DRESSED VEAL CARCASSES¹

VEAL CARCASSES. "Veal" is the term applied to carcasses from cattle slaughtered under about three months of age. The largest numbers are between three and six weeks when killed. It is estimated that 90 per cent are within this age range when slaughtered. In size the carcasses usually range from 50 to 150 pounds when skinned. The receipts of vealers are quite seasonal and mainly from the dairying areas, as more than three-quarters are marketed in the first five months of the year. Veal calves are more numerous on cattle markets accessible to large dairy districts. Following are the market classes and grades of veal carcasses.

<i>Class</i>	<i>Weight Division*</i>	<i>Grades</i>
Steers Heifers Bulls	1. Lightweight — 70 pounds and down	1. Choice or No. 1 2. Good or No. 2 3. Medium or No. 3 4. Common or No. 4 5. Cull or No. 5
	2. Medium-weight — 70 to 110 pounds	Same as lightweight, plus a Prime, or No. A-1 grade.
	3. Heavyweight — 110 pounds and up	Same as medium-weight, minus the Common, or No. 4 grade.

* These weights are with the "skin off" and should be increased by 10 per cent to include "skin on." Most veal carcasses are sold with the skin on or covered with some protective material.

Quality is the main item in determining the grade, being more important than conformation and finish. Sex has no influence on the quality of veal.

WHOLESALE CUTS OF VEAL. The method of cutting up the veal carcass differs on the different markets. The two main

¹ *Ibid.*

wholesale cuts are the hind saddle and the fore saddle. These are further divided, the hind saddle into: (1) leg, (2) loin, and the fore saddle into: (1) rack, (2) chuck. The latter cut includes the neck, shoulder, breast, and shank. These cuts are grouped into grades similar to those used for carcasses.

STAMPED OR BRANDED BEEF

Federal Graded and Stamped Beef¹

Standards developed by the U. S. Department of Agriculture for meat grading were first used in New York in 1924, mainly for the contract sale of meat.



FIG. 52. Roller stamping beef. U. S. Choice Chuck. (U.S.D.A., Agricultural Marketing Service.)

These classes and grades made possible the sale of meats for future delivery, based upon rather standard specifications. After a period of experimental demonstrations, grading and stamping was established in 1928 as a regular service, on a fee basis, under the provisions of the Federal Food Products Inspection Act. Grad-

ing offices are located in many meat packing and wholesaling centers.

The packer, wholesaler, or retailer for whom the grading is done pays for the services of the official grader, who is a federal employee, on an hourly basis. A roller stamp and a vegetable compound stamping fluid are used. The carcass is stamped the entire length, also the label appears on the principal retail cuts. Over 512 million pounds of beef were graded and stamped by government graders in the fiscal year 1937. Some packing plants have their own stamping and grading systems, used in lieu of, or supplementing, the government service.

¹"U. S. Graded and Stamped Beef," *Leaflet No. 122*, U.S.D.A.; "Beef Grading and Stamping Service," *Leaflet No. 67*, U.S.D.A.; "Facts on Meat Grading," *Consumer's Guide*, Vol. 5, No. 7, August 1938; "Federal Beef Grading," *Misc. Pub. 391*, A.M.S., U.S.D.A.

CARCASS MARKET CLASSES AND GRADES USED FOR STAMPING

The classes and grades as previously described are fixed by stated requirements, so there is no variation, seasonally or geographically. In July, 1939, a revision was made in federal beef grading to simplify the grades and to make it easier to buy on the basis of quality or grade. A single standard system was inaugurated under which the name of each class, such as steer, heifer, and cow, was eliminated from the stamp, and the graded carcass beef and wholesale cuts are divided into five classes:

(1) prime, (2) choice, (3) good, (4) commercial, and (5) utility. As a consequence, the buyers of beef are assured definite qualities in branded beef, which remain quite constant. The purchaser need not inspect each carcass or wholesale cut to secure a definite quality. It is claimed that the use of this system of grading protects the consumer against misrepresentation of quality and enables him to make intelligent price comparisons and to purchase the quality that suits his purpose. This service is used in the retail trade and also by federal, state, and city institutions, hotels, restaurants, steamship lines, and railway dining cars.



Packer Graded and Branded Beef

Packers often use grades of beef carcasses different from the federal grades and stamp or brand certain of the better grades. Grading in the Armour and Co.¹ plants is done at three different times. First, when the carcass has been split and washed it is

FIG. 53. Branding a quality product with a company brand name. (Swift and Co.)

¹ "Beef Grading," *Armour Magazine*, Vol. 4, No. 4, p. 9, June 1938.

graded by experienced graders. This is known as "hot grading." The following day the carcasses are "cold graded" in the coolers, and the last grading is done when the carcasses are "ribbed down" usually on the loading rack, prior to shipping out. In "ribbing" the beef carcasses, the hind quarter is separated from the front quarter, exposing the large muscle which lies on either side of the backbone. The color of the muscle, the marbling, and the texture which can be determined in this separation may affect the grade. There is quite close agreement in the grades made at different times for the trade or stamping.

Systems of grade identification are not the same for all packers.¹ Armour and Co. use 36 standard grades — nine for each of steers, heifers, cows, and the group bulls and stags. Respectively, they are designated as 30's, 40's, 50's, and 60's, and the commercial quality is indicated by the last figure of the number as follows:

0 — Prime	5 — Fair
1 — Choice	6 — Plain
2 — Good	7 — Common
3 — Good medium	8 — Very common
4 — Medium	

According to this system, a prime steer carcass would be indicated as 30, and the carcass would be blocky, or short coupled, with thick full ribs and loins, and plump rounds. The covering must be of thick, smooth white fat, neither "gobby" nor wasty. The meat must be firm, with bright red color, of fine grain, and well marbled. The vertebra where split must be red except in very heavy older steers, in which it is a pinkish white. A 38 steer carcass would be thin, with but little fat, which would be yellow. The meat is dark red and soft. In the application of this system, it will be noted that a good heifer would be 42; a medium cow 54; and plain bull or stag 66. These grades are for the wholesale trade and are not consumer grades. The latter consider tenderness and flavor principally, while the retailer in buying a carcass is influenced by many factors such as necessary trimming for resale.

¹ These are based upon what is known as the "institute system," which was developed by the Institute of American Meat Packers for the standardization of beef grading.

Retailer's Response to Grading and Stamping Beef

A significant number of Illinois meat retailers are handling graded or branded beef or both, reported Ashby *et al.* in 1938.¹ Government grade-stamped beef was more consistent in its grade than packer brand-stamped beef in the opinions of the retailers surveyed. It was pointed out that with a wide use of standard grades retailers would be able to make more accurate comparisons of wholesale beef quotations. This survey indicated that a number of consumers were interested in buying beef on the basis of actual grade and even consumers with lower incomes will buy quality beef when available:

*Kosher Beef²*

Beef from cattle slaughtered and dressed in accordance with certain Jewish rites is termed "kosher beef," which means that which is wholesome according to religious rules and regulations of the Jewish faith for edible beef.

If kosher beef is not used within three days after slaughter, it must be washed also every three days thereafter according to the rules of the Mosaic law. After 9 days it is no longer kosher and is referred to as "tref" and sold in the regular meat channels.³ As most of the over 3½ million Jews in the United States are in the eastern states, large numbers of live cattle are shipped from the large midwestern livestock markets to be slaughtered in or near the eastern consuming areas. By so doing the beef is

FIG. 54. Kosher beef with the kosher stamp of approval. (Swift and Co.)

¹ R. C. Ashby *et al.*, "Consumer Attitudes towards Government Grade-Stamped and Packer-Stamped Beef," American Society of Animal Production, *Record of Proceedings 32nd Annual Meeting*, 1939, p. 329.

² "What 'Kosher' Means to the Meat Industry," *Monthly Letter to Animal Husbandmen*, Armour and Co., Vol. 10, No. 3, June 1929.

³ "Kosher" means ritually prepared, or fit to eat, while "tref" is derived from "terefah," which means "torn by wild beasts."

available sooner after slaughter. Jewish holidays and festivals influence the meat trade because the buyers of kosher beef are absent from the market on holidays, kosher livestock seldom are slaughtered on Jewish holidays, and there is no kosher slaughtering on Saturday.¹

The requirement of the religious law is that veins must be removed before the meat is delivered to the consumer. In this country only the forequarters are used by the Jews and often the rib cut is removed. The kosher square-cut chuck which makes up about 33 per cent of the weight of a beef side consists of the ordinary chuck, plate, brisket, and shin, and includes four or five ribs of the forequarter. Other cuts also used are marked by Hebrew markings. As the poorer cuts are used from the carcass this trade requires high-grade slaughter animals. Usually the best heavy cattle and choice young cattle, mostly steers and some fat cows and heifers, are used for kosher beef.

¹ The Jewish holidays are given in "The Significance of Jewish Holidays to the Livestock Producer," *Swift and Co. Agr. Res. Bull. No. 9*, July 1937.

Chapter 10

BEEF AND VEAL DISTRIBUTION AND CONSUMPTION

Meat is usually delivered to the retailer by truck. Small meat packing plants maintain wholesale markets at which meat retailers can purchase their supplies. Some meat salesmen, representatives of the packing plant, travel a regular truck route and deliver meat as well as take orders. At points some distance from the plants, salesmen are used to gather the orders, and deliveries are made by rail or truck.

Branch Houses and Car Routes

Large packing plants develop two avenues of distribution, the branch house and the refrigerator car route. The branch house receives a supply from the packing plant of their company by refrigerator car or truck and serves as a distribution point for retailers. The car route system was first developed to serve retail meat dealers in towns and villages along a railroad line. A drayman meets the train on its arrival in a route town, and the goods for that town are unloaded and delivered to the dealer in that locality. With the development of better roads, refrigerated trucks have partially replaced the railroad service.

Meat Refrigeration

As meat is a perishable product, it must be refrigerated to maintain its freshness. The refrigeration must be at a rather narrow range in temperature and also with the proper humidity to maintain the meat in the most desirable condition. Ventilation is also a factor in successful refrigeration, and meat cuts must hang separately when refrigerated.

Refrigeration controls deterioration, and through its use an available supply of acceptable meat is widespread. Chilled beef may be held for a period of two to six weeks. Freezing, which will preserve beef for months without unfavorable effects,

is used under many circumstances. The quick freeze method is the most satisfactory for maintaining the original properties of the meat. In this method the temperature is lowered rapidly to about -35° F.

Qualities in Meat Desired by the Consumer

The consumer wants in meat palatability or that which is agreeable to the taste. The palatability or eating properties of the meat is influenced by the tenderness, juiciness, and flavor of the fat and the lean. Meat has savory and satiety value plus being high in food value. Attractiveness in appearance is a large factor in selling meat to the housewife. The proportion of lean and fat, and the color of both, affect the appeal of the meat to the buyer. Buyers prefer marbling in their beef, and most of them show a preference for either a light or medium red lean and a white fat. Some consumers show a preference for yellow fat although in beef grading white fat has the decided preference. Lower income groups discriminate more against the fat in beef, which is preferred by higher income groups.

To the buyer price is often the dominant figure in meat selection. The purchaser wants palatable meat at a reasonable cost. In fact, if the cost seems too high, meat substitutes are used or less meat is purchased. Meat constitutes a major expenditure and the main item in the usual meal; consequently the housewife selects meats with care.

A survey among American housewives indicated that 44.2 per cent preferred the quality of meat supplied by their present retailer, while 25.5 per cent were guided by convenience of location.¹ Economical prices were mentioned only in the case of the poorer classes. Where dissatisfaction existed with the meat dealer more than one-half of it was due to poor quality of meat.

Necessary Foods

Food is looked upon as a necessity rather than as a luxury. The expenditure for food is quite constant in the family budget. Information on how people spend their money obtained from

¹ Robert B. Hinman and Robert B. Harris, *The Story of Meat*, p. 235. Swift and Co., 1939.

the National Resources Committee has been the basis for the determination of a "luxury index."¹ With an average annual outlay per consumer unit of \$1502, about \$428 was spent for food. Of the various items, food with a luxury index of 54 appeared to benefit from increased spending power of consumers about one-half as much as all items combined. With higher incomes increased expenditures for food are for better quality and more services rather than greater total volume of food.

Meat had a luxury index of 44 as compared with wheat products 1, vegetables 36, dairy products 67, and fruit 79. In other words, meat to the consumer is in a higher luxury class than wheat products and vegetables but lower than dairy products and fruit.

Of the individual meats the luxury indexes are as follows: pork 18, beef 54, veal 58, poultry 80, lamb 100. Lamb, therefore, is the most luxurious of the meats, while pork is the lowest. Pork has then a low elasticity of demand as consumers tend to use the same quantity irrespective of price.

Per Capita Meat Consumption in Various Countries

Consumption of meat is greater in the new countries of the world than in the older countries. Food habits and religious restrictions, as well as the available supply, affect the amount of meat consumed. People in the temperate regions consume more meat than those in the tropics.

The meat consumption estimates of some countries have been summarized in the *Reference Book of the Meat Packing Industry*.² Although the estimates are rather incomplete, they indicate that at least three countries, Argentina, New Zealand, and Australia, have a higher meat consumption per person than the United States.

¹ Cornell University, *Farm Economics*, No. 123, February 1941. The luxury index is based on comparisons of expenditures by people of different income levels, and is weighted by the amount of total outlay for each group.

² *Reference Book of the Meat Packing Industry*, Institute of American Meat Packers, October 1938.

MEAT CONSUMPTION PER CAPITA, BY COUNTRIES¹

(Latest Available Estimates of Pounds Consumed Per Year)

Country	Beef and Veal	Pork and Lard	Lamb and Mutton	All Meats (and Lard)
New Zealand	183 (g)	28 (g)	110 (h)	(321)
Argentina	270 (d)	14 (f)	16 (f)	(300)
Australia	110 (h)	11 (j)	84 (h)	(205)
United States	62 (a)	87 (a)	7 (a)	156 (a)
Uruguay	132* (d)			
United Kingdom	66 (a)	41† (a)	29 (g)	(136)
Germany	45 (a)	86† (a)	1 (h)	(132)
Canada	61 (b)	58 (b)	6 (b)	125 (b)
Denmark	57 (a)	59† (a)		
France	48 (a)	40† (a)	6 (d)	(94†)
Belgium	39 (a)	44† (a)	2 (i)	(85)
Czechoslovakia	27 (g)	40 (g)	8 (g)	75 (g)
Union of South Africa	40 (g)			
U.S.S.R.	33 (k)			
Poland	17 (d)	29 (d)	1 (d)	47 (d)
Italy	19 (a)	12 (a)		41† (m)
Japan				4† (e)

(a) 1940; (b) 1939; (c) 1938; (d) 1937; (e) 1936; (f) 1935; (g) 1934; (h) 1933; (i) 1932; (j) 1931; (k) 1930; (m) 1935-37.

* Beef only.

† Lard apparently not included.

‡ Also fish, 104 lbs.

Meat Consumption Per Capita in the United States

Well-defined cycles in meat consumption occur which move with the volume of production of meats as most of our meats are domestically produced. Meat usually provides 25 per cent of the total protein and 15 per cent of the energy of our national dietary, yet we have marked fluctuations in consumption. We consume most of the meat we produce, and if our livestock population is high, meat consumption is high until livestock numbers are reduced. In times of liberal supplies meat moves into storage, while the reverse takes place when production is low. When good crops are produced livestock are marketed at heavier weights, using up feed surpluses. If the crop production is below average, livestock are sold at lighter weight but numbers are reduced. Since there is liquidation when feed supplies are short, this tends to keep the supply of meat fairly stable.

From 1900 to 1940 the average per capita consumption of beef was 60.8 pounds and of veal 7.1 pounds. See Figure 55.

¹ Source: Usually some U. S. Department of Agriculture publication.

The yearly consumption of beef per person has ranged from 46.3 pounds in 1932 to 74.1 pounds in 1909. Veal consumption has ranged from a low of 5.2 pounds per person in 1900 to 8.6 pounds in both 1924 and 1925.

Over the period of years there seems to be a definite downward trend in beef consumption and a slightly upward trend in veal

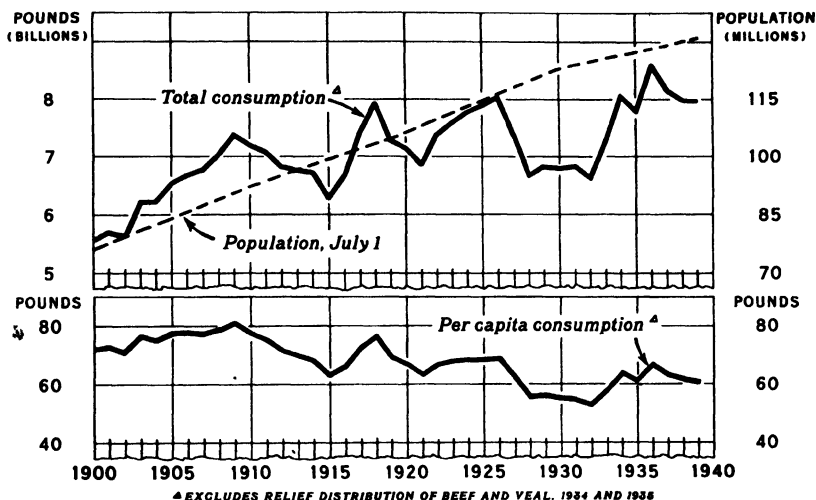


FIG. 55. Estimated total and per capita consumption of beef and veal, and human population, in United States.

consumption. Since about 1925 our exports of beef have disappeared and we have imported beef. Although per capita consumption has declined, the decline in production has been greater and population has increased.

Per Capita Consumption of Principal Agricultural Products

The per capita consumption of all farm products has remained quite stable since 1920. During the prosperity period it was but 2 per cent above the average, and in the depression it was only a fraction of a per cent below. The consumption of agricultural products is shown in the following tabulation.

Agricultural nonfood products such as cotton, wool, flaxseed, and tobacco vary more in consumption than the food products. Also they are affected more by changes in general business activity.

AVERAGE PER CAPITA CONSUMPTION OF
PRINCIPAL AGRICULTURAL PRODUCTS, 1920-1937 ¹

(Pounds per Capita per Year)

<i>Commodity or Group</i>	<i>Average, 1920-1937 *</i>
Cereal products	217
All potatoes	164
Sugar and sirup	110
Dairy products:	
Milk and cream †	328
Manufactured	45
Fruits	
Fresh ‡	186
Dried	6
Vegetables §	151
Lean meats and fish	132
Eggs	30
Beans, peas, nuts	14
Fats (excluding butter)	46
Coffee, tea, spices and chocolate	17
Total food	1446

* Consumption of foodstuffs in terms of estimated weight available for sale in retail market.

† Whole milk and cream in terms of whole milk.

‡ Fresh and canned fruit in terms of fresh fruit, on basis of total population, consumption of watermelons and cantaloupes per urban inhabitant.

§ Fresh and canned vegetables in terms of fresh, per urban inhabitant.

The consumption of meats showed a downward trend until recently but the movement has not been uniform. Two factors guide the food selection, one the taste preference and the other relative prices. Different foods compete with one another for their place in the consumer's diet. When we have prosperous times, the demand for the higher quality meats and the spread in retail prices of meats increase.

Retail Meat Prices

As the demand is not the same for all retail cuts, a price for each is used so that all the cuts will move into the trade. Shifts in consumer preference frequently occur, but definite cuts are in demand and consequently high priced, while others are in less demand and priced lower so they will sell.

For a ten-year period, 1930-1939, with good grade U. S. graded beef or comparable packer grades, the retail price of

¹ From *The Agricultural Situation*, B.A.E., U.S.D.A., January 1939.

sirloin steak for the United States has been 37.5 cents, and during the same period round steak 33.7 cents, rib roast 28.2 cents, chuck roast 21.5 cents, and plate beef 14.3 cents. In the retail market of New York City, porterhouse steak averaged 45 cents for a ten-year period, while sirloin was 39 cents, and top round steak 37 cents, veal cutlets 44 cents, and veal rib chops 31 cents.

Relationship of Cattle Prices and Beef Prices

The spread between the prices paid for cattle and the prices at which beef is sold is often questioned, both by producers and consumers. It should be pointed out that all of a beef steer is

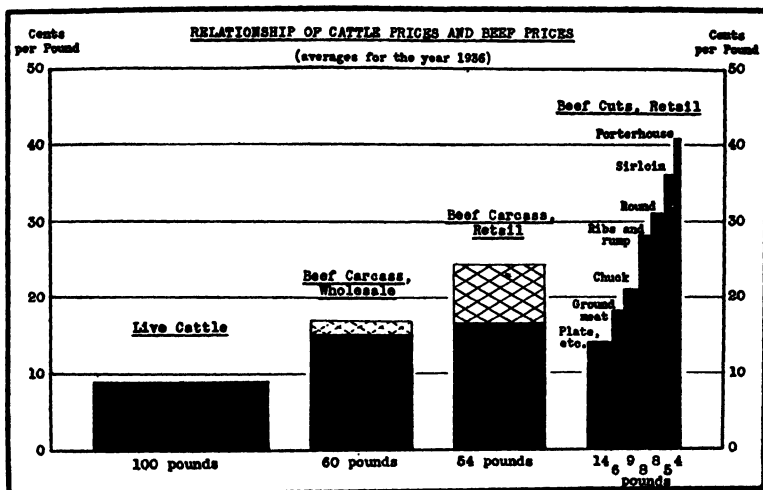


FIG. 56. Relationship of cattle prices and beef prices.

not carcass and that the different retail cuts of beef are not all equally in demand by the consumers. Higher priced beef cuts are those in greatest demand.

An explanation of the spread between live cattle and beef prices is given in the *Reference Book of the Meat Packing Industry*.¹ This is also shown in chart form. (See Figure 56.)

Live cattle of good grade averaged about 9 cents per pound during the period of the Chicago market. Cattle of this grade will yield about 60 per cent of carcass beef. If the purchase

¹ *Reference Book of the Meat Packing Industry*. Institute of American Meat Packers, October 1938.

price is to be derived from the carcass it would sell at 15 cents per pound. Meat packers usually add $1\frac{3}{4}$ cents per pound on the average to cover the expenses of dressing, chilling, and selling the meat and for freight and other distribution costs. By-products for the period yielded an income of about 2 cents per pound to the income for the carcass beef, so actually the



FIG. 57. Loading beef carcasses into a railroad refrigeration car.
(Armour and Co.)

meat packer could sell the carcass beef at $14\frac{3}{4}$ cents per pound. The meat retailer, because of cutting and trimming losses, has but 54 pounds of beef to sell for each 60 pounds of carcass purchased. The cost of retailing beef adds about 7 or 8 cents per pound to the cost of the meat to the consumer. The retailer then must average 24 cents per pound for the beef he sells for the period. In order to dispose of all the cuts the retailer must

range the price of cuts so that they all will be sold. Of the 54 pounds of beef from the original 100 pounds of live steer, there will be 4 pounds of porterhouse steak, which is sold for slightly over 40 cents per pound, while the 9 pounds of chuck is sold for about 21 cents per pound.

Meat Preservation¹

There are four general methods of meat preservation: drying, smoking, salting, and freezing. According to Wentworth, meat drying originated in the arid countries, probably in northern Asia, and the practice was brought to the American continent by immigrants who crossed the Bering Strait. Smoking no doubt came into use through the drying method. Meat drying was hastened by the heat from fires, and a smoke flavor was developed which would overcome objectionable odors of decomposition which arise on slow drying.

Salting has long been a method of meat preservation, and saltpeter has long been used as a preservative of the natural color. The dryness and hardness resulting from drying, smoking, and dry salting were overcome by the wet pickle method. Beef so preserved is known as "corned beef." Freezing was a natural development in the temperate and arctic regions. Meat storage by refrigeration developed with the growth of artificial refrigeration. Most beef is sold fresh and is refrigerated (not frozen) until it is retailed.

In the quick freeze process, the objectionable changes in meat subjected to ordinary freezing are eliminated.

Sausage²

As used in the trade, this term includes an extensive group of prepared meat products and is not restricted to ground pork alone. Beef is used extensively in various kinds of sausage. Large meat packers manufacture upwards of 150 different items in their sausage departments. Sausage is a highly concentrated

¹ "Meat Preservation," *Monthly Letter to Animal Husbandmen*, Vol. 14, No. 5, January-March 1939.

² "Growing Outlets for Beef," *Monthly Letter to Animal Husbandmen*, Vol. 16, No. 1, April-June, 1937.

"Importance of the Sausage Trade to the Meat Industry," *Monthly Letter to Animal Husbandmen*, Vol. 7, No. 7, October 1926.

meat product of rather uniform quality with but little waste. The development of its manufacture has enabled packers to utilize completely all meat products. Furthermore, it affords a means of softening the effects of market gluts of livestock because sausage is not a perishable product.

Sausage consists mainly of trimmings from the cutting rooms and certain special parts of cattle and hogs which are separated



FIG. 58. A retailer selecting beef at a meat packers' branch house.
(Swift and Co.)

from carcasses on the killing floor. Beef from bull carcasses because of its leanness is especially desirable for sausage. Other materials such as spices and cereals are blended with the meat to secure the desired flavor and consistency and to lower the cost. The commonly used cereals are rice, flour, corn flour, and potato flour. In plants under government inspection the cereals in most manufactured meat food products must not exceed $3\frac{1}{2}$ per cent of the weight of the finished product. Those with more than $3\frac{1}{2}$ per cent of cereal must be labeled imitations.

Sausage has increased in popularity and is widely used in the United States among all kinds of consumers — not only the lower groups, as in times past. It is a convenient product for the consumer because of its keeping qualities and because it requires no preparation. Although the consumption of sausage is increasing, there is a relationship between national income and sausage consumption. Total consumption of sausage was high in the years of 1919–1929 and 1935 when incomes were high. Apparently when incomes are lower, less prepared meats are purchased.

The kinds of sausage are divided into three main groups.

1. *Domestic Sausage.* This includes such items as fresh pork sausage, frankfurts, and bologna. Frankfurts (weiners) are approximately half beef and half pork, plus some less costly materials such as cereals and dried milk. After it is put into casings they are cooked and smoked.

2. *Dry Sausage.* This is often called "summer sausage." It is firm to the touch, low in moisture content, and is eaten without cooking. Dry sausage is popular with persons of foreign birth.

3. *Sausage Specialties.* The specialty products made in the sausage department include such materials as meat loaf, minced ham, jellied meat, corned beef, chili con carne, head cheese, and luncheon meats.

Cold Storage Locker Plants

Beginning about 1935 cold storage locker plants with individual lockers for storing foods increased materially in use. One of the first plants was at Chico, California, where such service was available to farmers for meat storage in 1908.¹ The first such plant in the midwest was started in 1910 at Crete, Nebraska, and in the early 20's lockers came into wide use in the Pacific northwest. A survey² in Minnesota in March 1939 indicated that of the 179 locker plants in the state 57 were cooperatively owned. The detailed information secured in this survey showed that 17 per cent of the patrons resided in town, and that of the

¹ L. B. Mann, "Refrigerated Food Lockers," *Circ. C-107*, Farm Credit Administration, 1938.

² A. A. Dowell *et al.*, "Cold Storage Locker Plants," *Bull. 345*, University of Minnesota, 1940.

meat handled 47.1 per cent was beef, 48.0 per cent pork, 2.3 per cent veal, 0.6 per cent poultry, 0.4 per cent mutton and lamb, and 1.6 per cent other meats.

Many of the locker plants maintain facilities for processing meat. The plants provide for slaughtering meat animals, processing, cutting, wrapping, and freezing meat, and also grind, cure, and smoke meat. Also they render lard as required by their patrons. Farmers use the facilities of the locker plants be-



FIG. 59. Buying meat at a modern retail market. (Swift and Co.)

cause through them they can secure fresh meat (frozen) throughout the year, either from their farm slaughter or livestock processed at the plant. The possibility of securing higher quality meats at some saving in cost, as compared with purchasing from the local retail meat dealer, attracts some patrons. On the basis of 500 pounds of meat per locker the cost to the urban locker renter per pound of meat stored will range from $4\frac{3}{4}$ to 7 cents per pound.¹ This includes brokerage for buying the meat,

¹ Marvin A. Schaars, *Cold Storage Locker Plants*, University of Wisconsin (Mimeographed), 1938.

processing charge, locker rental, shrinkage, curing and smoking of hams and bacon, and grinding hamburger and sausage. Time of purchase, volume used, and cost of service will affect the savings made.

The food storage by freezing in lockers makes possible improved diets for farm families. About 2800 frozen food locker plants were operating in 44 states in 1940. Their advantages for the storage of meats are: (1) meats preserved by freezing resemble more nearly fresh meat in flavor than canned meats; (2) home slaughter is less seasonal and can be done throughout



FIG. 60. A porterhouse steak. This cut is usually the highest priced of the common meat cuts. (National Livestock and Meat Board.)

the year; (3) less labor, materials, and equipment is needed than in preservation by canning; (4) waste because of spoiling due to improper canning and refrigeration is eliminated; (5) through the efficient use of cold storage lockers better meats are available for the farm families more uniformly throughout the year, with lower cost.

Rural electrification has been one of the causes for the expansion of cold storage lockers. Cold storage plants use electric power, and the electrical refrigerator in the home makes it possible to hold frozen food for a time before consumption. Some of the drawbacks to food lockers are that it is not always convenient to get the materials from the locker when needed, and it may be more costly than storage by canning and curing.

Meat Imports

Usually exports of beef and pork exceed our imports, but this is not always the case. Following drought years with decreased livestock numbers and resultant decreases in domestic supplies, imports of both beef and pork are attracted.

Normally we import considerable canned beef from South



FIG. 61. A porterhouse steak prepared for the table. (National Livestock and Meat Board.)

America, mainly from Argentine and Uruguay. Eighty to 85 per cent of this is canned corn beef. Because of quarantine regulations to prevent the introduction of foot and mouth disease, fresh beef is not imported to the United States from South America.

Import duties. Beef and veal, fresh, chilled, or frozen, are subject to a duty of 6 cents per pound under the tariff of 1930. Canned beef is subject to an import duty of the same rate but not less than 20 per cent ad valorem. Fresh, chilled, or frozen pork is subject to a duty of $2\frac{1}{2}$ cents per pound while hams, shoulders, bacon, and other prepared and preserved pork are subject to a tariff of $3\frac{1}{4}$ cents per pound.

Chapter 11

BEEF CATTLE FEEDING AND MANAGEMENT

FEEDING OF BEEF CATTLE

The development of a beef calf is largely dependent upon the individual's inheritance and the nutrition that it receives. The quantity and quality of the feed determine to a large degree the growth and development of the individual, the capacity for which is inherited. Other factors which may alter the growth are water supply, temperature, and light. Development may also be affected by toxic substances in the ration, for example, the presence of selenium in forage. In the United States feeding practices with beef cattle differ widely from one section to another, depending upon the feed supply and climatic conditions.

It is not the intent to cover all of the details of feeding in this text. Rather, a survey of nutritional requirements, and of beef cattle feeding and management practices is given. Several references on livestock feeding are listed in the appendix. Following is a discussion of the feeding problems in beef cattle raising.

Nutritional Requirements of Beef Cattle

USE OF NUTRIENT MATERIAL

The nutrients in feeds are used mainly by young cattle for growth and fattening. Protein, carbohydrates, fats, minerals, and vitamins and water are consumed so that they may yield their sustenance to the animal, and this is reflected mostly in growth and fattening after the maintenance requirements have been met. Food is digested and its nutrients become available for absorption, after which it enters circulation and is carried to the place where it is used. Finally when nutrient material is broken down to the metabolic end products, these are excreted.

The use of food by cattle may be listed as follows:

1. A large portion of the food consumed in the young animal is used for growth and development of the body tissues. Growth is the coordinated increase in the structural and other portions of the body which takes place until the individual becomes mature or is an adult. This includes the formation and size increase in such tissues as bone, muscle, skin, and horn.

2. Nutritive material is also used to repair and replenish worn-out tissue.

3. In some animals considerable nutrient substance is used for the formation of body fat.

4. Another function of food is to provide energy to yield heat or perform work.

5. In the productive female, other nutritive needs are manifest, that of fetal development and for milk production.

Food may be regarded as serving two purposes: maintenance and production. Under the first is included the needs for maintaining the body or for the upkeep of body tissues, body temperature, and the energy for the vital processes such as the beating of the heart. Production implies the accumulations arising from growth, fattening, and fetal development, as well as milk and work production.

ESSENTIAL NUTRIENTS

Certain food constituents are essential to the normal growth and development of an individual. The term "nutrient" refers to any food constituent or group of food constituents of similar composition which aid in the support of animal life. When first used it applied to the common group protein, carbohydrates, and fats. Now we regard the following as essentials in the diet or ration.

1. Proteins.
2. Fats.
3. Carbohydrates.
 - a. Crude fiber.
 - b. Nitrogen-free extract.
4. Minerals.
5. Vitamins and similar materials.
6. Water.

REQUIREMENTS OF BEEF CATTLE

Feeding standards, which are tables of feed composition and animal requirements, are generally based upon two groups of nutrients, protein and energy-producing nutrients.

The protein requirement is generally given as digestible protein, which is the part of the total that is removed in passing through the digestive tract. The energy-producing nutrients are expressed in various standards as digestible carbohydrate equivalent, total digestible nutrients, or net energy. In feeding standard the dry matter is also listed because if this requirement is not met the individual is not satisfied.

By means of feeding standards we can ascertain the average nutrient needs for a common farm animal and then combine together feeds in the correct proportion to approximate the needs.

A 1000-pound beef cow that is pregnant and being wintered should have daily, according to the Morrison Feeding Standard,

<i>Dry Matter, Pounds</i>	<i>Digestible Protein, Pounds</i>	<i>Total Digestible Nutrients, Pounds</i>	<i>Nutritive Ratio</i>	<i>Net Energy, Therms</i>
14.2-20.0	0.6-0.7	7.5-10.5	1 to 10.0-15.0	4.9-6.8

With the composition of the available feeds known it can be readily seen how a balanced ration may be determined. The requirements given above would be met by a ration consisting of 25 pounds of corn or sorghum silage, 10 pounds of straw or stover, and 1.5 pounds of cottonseed meal.

It will be readily recognized that the balanced ration, if based upon total protein and energy nutrients needed, may not fulfill the needs for the quality of the nutrients or the minerals or vitamins.

RELATION OF WEIGHT TO MAINTENANCE

Many conditions affect the requirement for maintenance. Such things as size, age, weight, and sex influence the amount of food needed daily for maintaining the tissues of an animal. Submaintenance feeding results in the breakdown of tissue and loss of weight. The maintenance needs are proportional to the weight of the animal, but the proportion is not direct. For example, a 1000-pound steer does not require twice as much feed for maintenance as a 500-pound steer. The active tissues of the

body do not increase in direct proportion to gains in weight, and, further, heat losses are more in proportion to body surface than weight. Consequently maintenance feeding standards are proportional to some power (0.73 for energy, 0.72 for protein) of the live weight.

An illustration of the application of this principle may be given from the data in Morrison Feeding Standard.

MINIMUM REQUIREMENT PER HEAD DAILY FOR WINTERING
PREGNANT BEEF COWS

<i>Weight of Cow, Pounds</i>	<i>Digestible Protein, Pounds</i>	<i>Total Digestible Nutrient, Pounds</i>
1000	0.60	7.5
1100	0.64	8.0

It will be noted that a 10 per cent increase in weight does not call for a 10 per cent increase in minimum of digestible protein and total digestible nutrients.

GROWING AND FATTENING REQUIREMENTS

In common feeding practices growth and fattening go on simultaneously in beef cattle from birth to maturity. With steers being finished for market the fat percentage increases materially on heavy feeding. During that period the water and protein percentage decreases while the mineral matter or ash decreases gradually.

The feed requirement for steers that are being fed out for market must be sufficient to take care of maintenance and to provide a surplus to make possible weight increases. The amount of the latter is dependent upon the amount and quality of the feed consumed.

A comparison of the nutritive needs can be made from data in Morrison Feeding Standard for 900-pound steers of the different classes.

DAILY REQUIREMENTS PER 900-POUND HEAD

	<i>Digestible Protein, Pounds</i>	<i>Total Digestible Nutrient, Pounds</i>
Growing beef cattle fed liberally for rapid growth	1.17-1.32	10.0-11.8
Calves being fattened for baby beef	1.75-1.95	13.8-15.8
Fattening yearling cattle	1.74-1.94	14.8-17.4
Fattening two-year-old cattle	1.62-1.83	14.6-17.4

The protein requirement is higher for the calves and yearlings than for the two-year-old cattle of comparable weights because of the greater need for growth. The two-year-old steers, on the other hand, have a larger capacity for feed. The total digestible nutrients required are also higher.

REPRODUCTIVE AND LACTATION REQUIREMENTS

A new-born calf is more than two-thirds water. There is also an accumulation of protein, fat, and minerals in the growing fetus which calls for an increase in intake of nutrients in the pregnant cow. In normal reproduction there is also an increase in the weight of the cow other than the fetal growth. Inadequate nutrition will hinder normal lactation and reproduction.

Since milk production is a secondary consideration with beef cows, the nutrition needs for this are not great.

Practices in the Feeding of Beef Cattle

A division of the subject of the practices of feeding might be made upon the basis of the age of the cattle being fed and the principal purpose for which they are fed. Problems in feeding and management pertain to the breeding herd, the calf crop, and fattening cattle for market. Season likewise may be used as a further dividing of the previous divisions. The year's plan and program may be divided by the season, summer or winter, for the feeding management is not the same in all seasons.

THE BREEDING HERD IN SUMMER

The herd of beef cattle is turned on the pasture or the range for pasture season. Feed other than pasture with the exception of salt or mineral is not usually allowed, and the forage comprises the bulk of the feed. The breeding herd is limited in most instances to the amount of grazing land available. On good pasture or range when the herd is not crowded, nutritional conditions are at their best and sanitary conditions unsurpassed. Further pasture is comparatively a low-cost feed in most cases. It is desirable to use pasture as completely as possible for the breeding herd.

There are two kinds of pasture, the native grass on permanent pastures such a bluegrass, buffalo grass, etc., and the crop pas-

tures such as the clovers. In farming areas the latter are used somewhat for the breeding herd as they may be a part of the crop rotation. The crop pastures usually give greater yields, and the excess can be used for hay. Good pasture in the corn belt will carry one cow per acre. With permanent pasture more area is needed. In the western range country 20 to 40 acres pasture



FIG. 62. A beef breeding herd of Hereford cows and their calves on pasture. Good pasture is essential for the economical maintenance of the breeding herd. Buck and Doe Run Valley Farm, Coatesville, Pa.

per cow per year is often used. Supplementary feeding is practiced when forage is short.

Overgrazing may cause damage to pastures and ranges and is inadvisable. Moderately heavy grazing will give greater gains per acre than light grazing, and with good management heavy grazing can be successfully practiced. Provision should be made if the pasture is heavily stocked to supplement the pasture if drought conditions prevail. If cattle fail to make fair gains during the pasture season the stocking is too heavy.

THE BREEDING HERD IN WINTER

The crucial period in the feeding and management of the breeding herd is during the winter season. Ample supplies of feed and adequate housing are prerequisite to success in winter handling. As economy is foremost in feeding the herd, roughage under most situations comprises the major portion of the ration. Concentrates are used only when the supply or quality of the roughage is inadequate. In farming areas the crop fields are commonly gleaned by cattle, and in the winter wheat area this crop may be pastured during the winter without adversely affecting the grain yield. Hays and silages are used to supplement the graze from crops. As cows are on pasture at least one half of the year they can withstand a good deal of winter underfeeding. In sections where winter shelter is needed for reasonable comfort, sheds or barns open to the south will suffice in most situations. Economy is to be applied in providing shelter; elaborate buildings are not necessary.

The feeding of concentrates usually increases the cost of the ration. The need for such feeding is dependent upon the condition of the cattle as well as on the quality and quantity of the remainder of the ration. The condition or fleshing of the cow herd will indicate the sufficiency of the ration. When the cows fail to gain in weight and lose flesh, a protein supplement is indicated if the ration is carbonaceous. If the protein intake is ample, concentrated feeds like grain are needed. Cows heavy in calf or suckling calves may need special feeding. On the range when the winter pasture is insufficient cattlemen often resort to the feeding of cottonseed, soybean, or linseed cake, from 1 to 2 pounds per cow per day, or an equivalent amount of other feed such as grain or hay. There has been an increased use of feeds in pellet or cube form for range feeding and these include energy-rich feed with protein supplement. When the vegetation is snow-covered and the temperature low supplemental feeding is indicated.

THE CALF CROP IN SUMMER

Most beef calves are dropped on pasture. On corn belt farms spring calves are heavier at weaning time, and the crop is larger

than with fall calves. The cost of keeping the cow herd on farms is lower when spring calves are produced.

A. Under farm conditions. If pasture conditions are good the calves are allowed to graze with the cows except on some farms where the calves are kept in a barn or lot near the barn while the cows are pastured some distance from the farmstead. In the latter case the cows are brought to the calves for suckling twice daily. The use of a creep permits the feeding of grain or other concentrates to the calves without interference from the cow herd. Farm-grown calves may be raised on skim milk like dairy calves if expedient.

B. On the range. Calves receive no special care unless it is necessary. The cows drop the calves on the range, and the calves continue on the range with the cows. The attendant is on hand to give such service as may be necessary. Dehorning, castration, marking, branding, and vaccination for blackleg are completed at the time of the round up. When calves are six to eight months old they are weaned by separation from their dams.

THE CALF CROP IN WINTER

The spring calves are weaned at the end of the pasture season in the fall. Fall-born calves are more difficult to raise than those dropped in the spring as they are smaller and less able to withstand adverse weather. Further, the winter rations often are inadequate or incomplete as compared with a ration including pasture. Fall-dropped calves require heavier winter feeding and more shelter than spring-dropped calves. Spring calves and yearlings do require some special attention during the winter season as that time may be a crucial one in their development.

THE FATTENING OF CATTLE IN SUMMER

In some areas of the United States fairly well-finished beef is produced on pasture alone. In general, summer feeding is feeding on pasture and winter feeding is dry-lot feeding, although such is not always the case. Even during the pasture season many cattle being fed are kept in dry lots. The fattening period may extend through the winter and the summer, especially

with young cattle. It has been found to be a poor practice to put fattening cattle on grass if they have been on heavy concentrate feeding in dry lot. Cattle fed only roughage in the winter may well be finished on grass.

For sufficient finish on the cattle to sell well it is generally necessary to feed concentrates plus the pasture. The combination feeding plan, that is, grass and concentrates, is followed mostly in areas where forage is to be used and where grains are



FIG. 63. Cattle being fed on pasture. Hereford steers from the T. O. Ranch being fed out at the Southside Stock Farm, Rockbridge, Ill.

grown. Under this system the concentrates needed are about half that used in dry-lot feeding. When feeder cattle are purchased, two year olds or older cattle are preferred for this method.

THE FATTENING OF CATTLE IN WINTER

The feeder and stocker cattle raised in the western range area on the native short grasses move for finishing into regions where concentrated feeds are grown. More than half the cattle are finished in the corn belt. Corn is the most used of our basal

concentrates for cattle fattening, although barley, rye, grain sorghums, oats, wheat, and molasses are used. Cottonseed meal and similar protein concentrates are used to build up the protein content of such rations. Silage, especially corn, is used in great quantities as is also alfalfa, clover, and other hays.



FIG. 64. Fat cattle in the feed lot. Hereford steers being fed out at Sugar Grove Farm, Aurora, Ill. Note the hogs following the cattle.

Stock of Feeds and Livestock Feeding

In years when feed production is at a high level, feeding is stimulated, livestock numbers increase. Slaughter animals are fed to heavier weights. Storage stocks of meats increase, and supplies of feed are accumulated on ranches and farms. When short crops are raised the reverse takes place, and feeding is restricted, numbers of livestock decrease, slaughter animals are marketed at light weights. Storage stocks of meat are lessened and surplus feed supplies disappear. Livestock absorb part of the impact of extremes in feed production, because there is liquidation of livestock with short feed supplies and expansion when feed supplies are generous.

MANAGEMENT OF THE BEEF CATTLE ENTERPRISE

The role of the manager is to see to it that the livestock on the farm or ranch do well the things they are kept for. The efficient manager directs the economical conversion of the home-grown feeds into livestock products. A plan of management suitable to the situation is the first essential in successful production, and this is followed as a guide to the objectives.

A Plan of Management

Whether the final objective is the production of commercial beef cattle, feeder cattle, or breeding cattle, there are certain circumstances which the operator should consider in formulating a plan. A discussion of these major considerations which may affect such a plan follows.

THE USABLE FEED SUPPLY

As cattle are kept primarily to use feed a careful estimate of the probable supply and the amount needed is imperative for careful planning. Rations carefully planned to use all home-grown feed efficiently plus purchased supplements are essential for economical production. A margin of safety is also essential as insurance against a forced liquidation when natural supplies fall short, such as in droughts or crop failures. A balance between usable feeds and animal needs is desired.

THE EQUIPMENT REQUIRED

The equipment and building needed for cattle enterprise need not be extensive or expensive. Most general farms are sufficiently equipped for handling a lot of feeding cattle, or a cow and calf enterprise. A herd of 20 breeding cows or an equal number of fattening cattle should be the approximate minimum for a small farm.

THE LABOR INVOLVED

A plan of cattle raising should consider the labor available, both man and horse, and also the competing labor demands. Cattle feeding may dovetail very well with general farming in labor demands. A use for labor is provided in cattle feeding which will give a return when other uses are very small. A

study¹ on corn belt farms indicated that 6½ hours of labor per year were required to care for a stock cow on the average farm, while milk cows on these same farms required an average of 99 hours.

THE MARKET OUTLOOK

The immediate outlook as well as a long-time view are pertinent to profit in cattle raising. In planning a system of cattle raising attention should be given to the factors that affect the prices of the kind produced. Outlook reports are available, and the usual seasonal variation in the different classes and grade have been discussed. With commercial cattle the manager should endeavor to have the kind that are in demand ready for market when the prevailing market price is relatively high. This involves a knowledge of what is wanted and when the supply is low in comparison with the demand. A good manager will avoid mistakes in when and where to market and also will know when and where to buy feeders or other replacement stock. To top the market with beef steers is the fond hope of many cattle producers, and this means the best selling load or group of steers on a particular market on any marketing day. It is not always related to the most profit from the feeding enterprise.

The cycle of cattle numbers previously described is related to cattle prices and probable profits. The skilled operator takes advantage of these changes in profitability by altering his plans.

KEEPING RECORDS

A livestock enterprise involves many phases and also many transactions. To direct the business many rather detailed written records are helpful to the operator. With such information at his disposal the manager may know what phases or parts of the enterprise are profitable. The management plans should be altered when the project is unprofitable and the elements entering into production costs, such as feed, labor, equipment use changed so that profits are made. The most desirable records depend upon the nature of the enterprise.

¹ J. A. Hopkins, W. D. Goodsell and R. K. Buck, "An Economic Study of the Baby Beef Enterprise in Southern Iowa," *Research Bull.* 272, Iowa Agr. Exp. Sta., April 1940.

For cattle feeding few records are needed, with a cow and calf business more records are desirable, and with a purebred herd still more records are needed. A financial record is advantageous with a cattle feeding project. With breeding herds, breeding, production, identification, and marketing records are helpful. Records permit intelligent selection of individuals for the breeding herd. With a purebred herd such records are indispensable. A program of breeding and a schedule of matings are essential adjuncts in selection.

The exact plan will vary with the nature of the enterprise as well as with the various features of the individual farm or ranch. A suitable plan will provide for the efficient use of all the facilities of the plant for the particular kind of production. Extra supplies of feed may be consumed by expansion while short crops will naturally cause a restriction.

Specific Problems of Management

Feeding and management overlap in any livestock enterprises. Many tasks which require the attention of the operator, usually at a specific time, may be regarded as managerial. Commercial feeding or cattle finishing presents the fewest problems of management of any of the beef cattle enterprises. A cow and calf herd involves a breeding program and a continuous selection plan. Furthermore, care of the calves entails such items as starting on grain, dehorning, castration, blackleg vaccination, and weaning. Under range conditions the handling of cattle requires special equipment, such as corrals and dehorning and branding chutes.

Chapter 12

BEEF CATTLE BREEDING

Robert Bakewell, an English farmer who lived from 1725 to 1795, is credited with being the founder of the study of animal breeding, which, briefly stated, is the reproduction of animals and their improvement. His activities in the breeding of Longhorn cattle, Leicester sheep, and Shire horses became noteworthy about 1760. His success is attested by the demand for his rams, which were auctioned at annual ram-lettings. As much as 1200 guineas was received for the yearly rental of a ram. Many breeders of livestock studied and followed his methods. Bakewell established such principles as "like produces like," "breed the best to the best," and "inbreeding produces prepotency and refinement." His livestock improvement program was to improve his productions in (a) utility of form, (b) quality of flesh, and (c) efficiency in the feed lot. Bakewell kept records and his success in livestock production marked the beginning of livestock improvement.

The Shorthorn herd book, started in England by George Coates in 1822, was the first cattle herd book to be established. A herd book to record the pedigrees of horses winning important races was started in 1791.

In order to understand how inheritance may be affected we should consider the reproductive process, the breeds, breeding systems, and breeding stock selection, which are briefly discussed in the following paragraphs.

Livestock producers by various mating systems and the use of selection can to some extent control the heredity of their animal productions. As chance is involved in the segregation and recombination of the characters, perfect control is by no means possible. All progeny of a mating are not the same except in the case of identical twins because each individual develops from a separate ovum and sperm and each receives a

sample of inheritance from the sire and the dam. Control then is possible in the animals producing and in the matings permitted.

The Reproduction Process

REPRODUCTION

Heifers will arrive at sexual maturity soon after they have reached one year of age. Ample nutrition will speed up the advent of puberty, while a low plane of nutrition will arrest the sexual development. The "in heat" period or oestrus is a part



FIG. 65. Model Hereford breeding bull, T. Royal Rupert 15th, undefeated grand champion bull, 1940. Owned by Turner Ranch, Sulphur, Okla. (American Hereford Association.)

of the oestrous cycle. This cycle is a series of changes in the reproductive tract and related organs which is completed usually in about three weeks. Toward the end of the oestrus one or more ova are shed from as many Graafian follicles on the ovary and pass through the oviduct to the uterus. Mating at this

time, if conditions are favorable, will result in a union of the ovum and the sperm (fertilization) and pregnancy.

The period of oestrus is about 12 hours in length and these periods are usually 21 days apart. The heat periods are quite uniform throughout the year in cattle, but there is some tendency for intensification in the late spring and early summer. Upon conception, a pregnancy period of 282.1 days occurs under nor-



FIG. 66. Model Hereford breeding cow, Donlette Jordan, grand champion female at 1940 American Royal and International Livestock Exposition. Owned by Black and Largent, Granbury, Texas. (American Hereford Association.)

mal conditions, although the period may range from 270 to 290 days. As the standard deviation is about five days, about two-thirds of the pregnancies would terminate within the range of 282.1 ± 5 days. The average birth weight is 85 pounds with a range from 40 to 140 pounds. It is usually advocated that heifers not be bred until they are over 20 months of age as calving at a young age may affect the ultimate size of the cow and the growth of the calf until weaning time.

A yearling beef bull may be used for service, but should not run with the cow herd. A yearling may be used for 12 cows during a breeding season and a two year old for 25 to 30 cows. A mature bull can be used to breed 40 to 50 cows in a season. With pasture breeding the number is reduced about 50 per



FIG. 67. Model Aberdeen Angus bull, Envious Blackcap B 6th, grand champion bull of the International Livestock Exposition, 1939. Also a sire of note. Owned by Elliott Brown, Rose Hill, Iowa. (American Aberdeen Angus Breeders' Association.)

cent. In the western range country one active mature bull is kept for each 20 to 30 cows.

BASIS OF INHERITANCE

The gametes or male and female sex cells result from a process whereby the chromosomes are reduced to one-half of the number in the body cells. In cattle it is believed that there are 24 pairs of chromosomes which carry the hereditary factors. The units of heredity are the genes, which are arranged on the chromosomes. In the development of the sex cells (oögenesis

and spermatogenesis) and the loss of one-half of the chromosomes the chances are even as to which of a pair is retained and which is lost. In fertilization the resultant zygote has the sum of the chromosomes of the two gametes, the same as the number characteristic of the species.

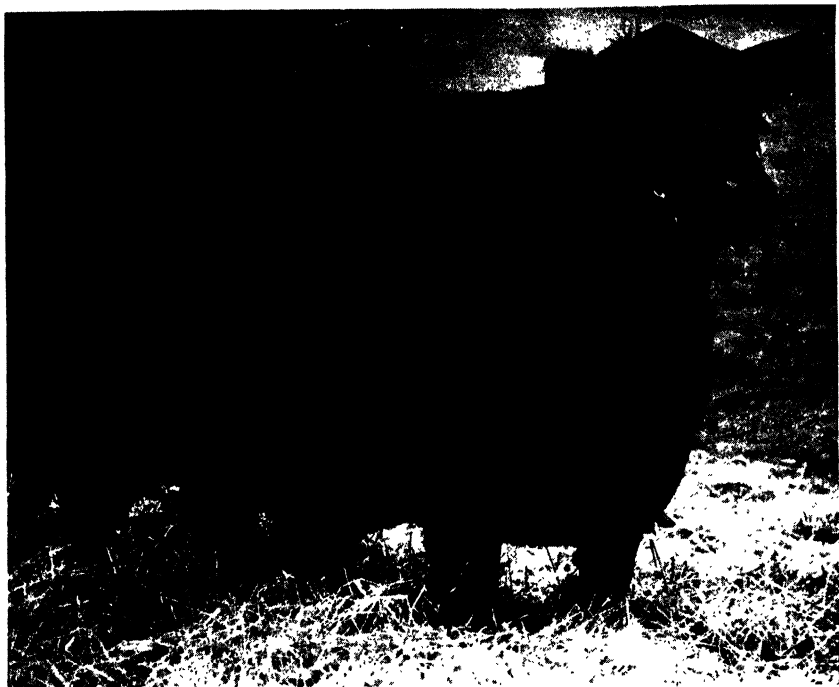


FIG. 68. Model Aberdeen Angus breeding female, Erianna B 6th, grand champion female at 1940 International Livestock Exposition. Owned by Elliott Brown, Rose Hill, Iowa. (Carl Oldsen, Iowa Beef Producers Association.)

PREPOTENCY

Certain individuals have the property of being able to transmit their characters to their offspring to a higher degree than others. This ability, known as "prepotency," is based upon dominance, which is the overshadowing by a character on the effect of the other or opposite member of an allelomorphic pair. For example, in cattle the polled character is dominant while the allelomorph (horned) is recessive. A polled bull mated to a horned cow will produce calves that are nearly all hornless, as the polled

character is nearly complete in its dominance. Occasionally scurs occur, especially in the second and third generations of crossbreds; consequently this character is not a simple dominant-recessive in its behavior.

MULTIPLE BIRTHS

Twins occur occasionally while triplets and quadruplets are comparatively rare. In beef cattle there is about one twin birth in every 200 births. The rate of twinning is higher in dairy cattle, which have one twin birth to every 50 to 60 births. Twins are 10 per cent lighter in weight than single calves. Also twin calves have a shorter gestation period than single calves. In cattle very few identical twins occur. These come about from the division of a single fertilized egg, and it is estimated about 6 per cent of cattle twins are of this kind. In the remaining 94 per cent of twins the origin is from two fertilized ova; consequently they are no more alike than full brothers and it is possible that they be half brothers, that is, when they are by different sires. Also twins may be of different ages as the female may rarely ovulate when pregnant, and subsequent pregnancy may occur.

FREE MARTIN

With twin cattle there may be an intermingling of the blood supply of both fetuses. If they are of the same sex, no abnormality in development results. However, if they are of different sexes, the male hormones, which develop before those of the female, will arrest the development of the reproductive organs of the female twin by stimulating the recessive male characters. A heifer born twin to a bull is sterile in all but 1 in 12 times because of this condition, and such heifers are known as "free martins." Apparently in the exception vascular anastomosis does not take place. In mammals other than cattle the condition giving rise to "free martin" rarely occurs.

TIME OF CALVING

By far the greatest percentage of the calves are born in the spring. About 50 per cent of the calf crop is dropped in March, April, and May. There is also an increase in calving in Sep-

tember and October. There are advantages in favor of either spring or fall calves, but on the range spring calving is the most advantageous. Spring-dropped calves get more milk from their dams, are better able to withstand winter weather than fall calves, and can be sold at weaning time in the fall. Fall calving is more commonly practiced under farming conditions than on the range.

ARTIFICIAL INSEMINATION¹

About 1780 artificial insemination was practiced on dogs by Lazaro Spallanzani, an Italian scientist. It is also reported that the Arabs used artificial insemination on horses prior to the Christian era. With the accumulation of greater knowledge of the reproductive process, the properties of semen, and the development of techniques, greater use has been made of artificial insemination with domestic animals. It has been used quite successfully with cattle, sheep, and horses. By its use the service of a sire may be extended in number as one ejaculate of semen can be used for several females, the various features which limit ability to mate can be overcome, and the semen is capable of storage and shipment. Bull semen was sent by air express from Washington, D. C., on September 19, 1936, to Buenos Aires, Argentina, and was successfully used for insemination. The estimated distance was 6200 miles, and seven days elapsed from the collection to the insemination.

Special equipment is needed for the practice of artificial insemination, also it requires more time than direct service. Unless care is used in the practice, it may disseminate disease from herd to herd.

Cooperative organizations have come into existence for programs of artificial insemination. A group of dairy farmers in New Jersey, owning about 1000 cows, formed such an organization May 16, 1938.

Beef Cattle Breeds

The objectives of the purebred breeder are somewhat different than those of the commercial beef raiser. The latter is con-

¹ See "Artificial Insemination in Livestock Breeding," *Circ.* 567, U.S.D.A., October 1940.

cerned only with characters that have to do with efficient beef making and high carcass value. Breed-distinctive features are considered by the breeder of purebreds, and there is not a high correlation between many of the breed characters and economical production. The function of this group is to maintain registered purebred herds of such merit that the commercial cattle



FIG. 69. A champion Shorthorn bull, Sni A Bar Ensign, grand champion at the International Livestock Exposition. Owned by Sni A Bar Farm, Grain Valley, Mo. (American Shorthorn Breeders' Association.)

raiser will be able to secure for his use bulls and probably some cows that will improve his herd.

PUREBREDS

Purebreds are the offspring of individuals which are recorded in the herd book of a record association, and which meet the requirements for registration.¹ A breed is a group of animals

¹ For a discussion of the origin, characteristics, and adaptabilities of the various breeds reference should be made to the following textbooks upon the breeds: H. W. Vaughan, *Breeds of Livestock in America*. R. G. Adams Co., Columbus, Ohio, 1937; C. S. Plumb, *Types and Breeds of Farm Animals*. Ginn, Boston, 1920.

having a common origin and possessing certain distinctive characteristics not common to other members of the same species. Genetically they are not pure in the sense that they are "homozygous." However, purebreds are less heterozygous than the foundation stock from which they were derived. It has been estimated that cattle will lose about 10 per cent in the amount of heterozygosity in a century of time under usual breeding practices.

Most of our purebreds are of European origin, and when intro-



FIG. 70. A champion Shorthorn female, Belle of Levedale, grand champion at the International Livestock Exposition. Owned by Mathers Bros., Mason City, Ill. (American Shorthorn Breeders' Association.)

duced they were used in commercial livestock production to grade up herds. Marked improvement followed the use of purebreds on the so-called common stock. Consequently a period of rapid expansion in the purebred herds followed and continued into the 1920's. Since that period of rapid expansion, breed associations have given more attention to breed improvement or the raising of the merit of the breeds. We have in most breeds a sufficient number produced which can be sold at a profitable price. However, there are many commercial herds that could be improved by the use of a good purebred

bull, and the supply of outstanding herd sires is far from sufficient to meet the needs of the purebred herds. Our means of identifying the sires of high merit are in need of improvement.

CHOOSING A BREED

Some cattlemen regard the choice of a breed in beef cattle as unimportant, as there is much variation within a breed. All

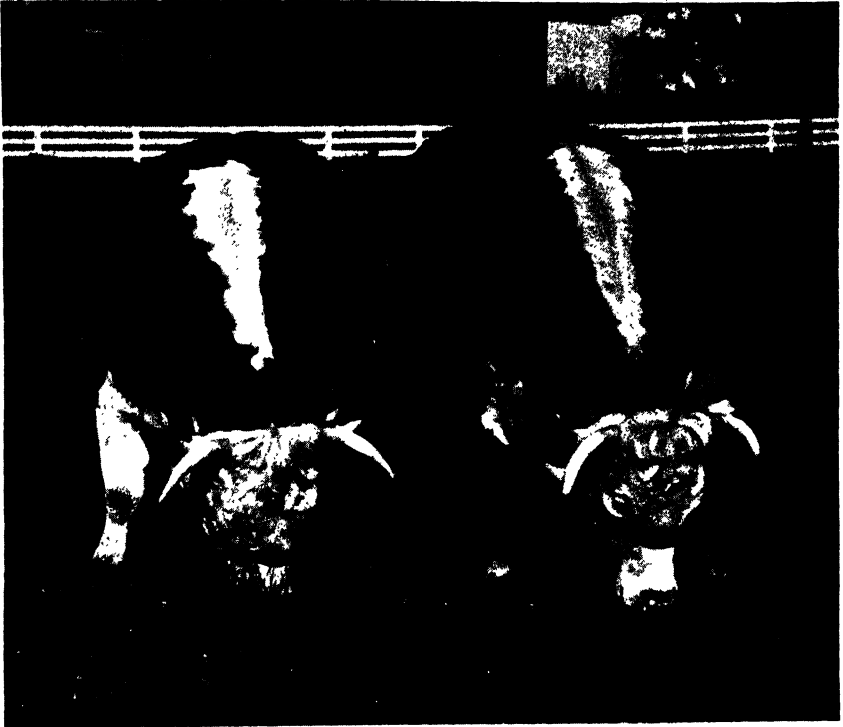


FIG. 71. Front view of two Hereford heifers. Great width is typical of the ideal beef form.

biological material is variable. A range in any character that influences the merit of a breed is to be expected. However, there may be an actual difference in the average between breeds in merit. Likewise there may be within a breed groups such as families or strains of superior merit. In beef cattle it may be difficult to separate differences in beef qualities due to heredity or breeding from those caused by nutrition and environmental factors.

The breed raised in the area is an important point to consider in making a choice of beef breeds. If the selection is made of the popular or numerous breed in the community, breeding stock is available locally, methods of successful producers can be observed, and there may be advantages in disposing of the production of the herd. Such additional considerations as market requirements and demand for the kind produced, ability to graze and utilize roughage, adaptability to the environmental conditions, early maturity, and hardiness should be given consideration in choosing a breed. Personal preference or fancy should be secondary to features that affect economic value.

The breed selected is probably of less importance to the commercial cattle raiser than to the purebred breeder provided the breeds are equally adaptable to the circumstances and of equal productive capacity. The purebred breeder is subject to the effect of expanding or contracting numbers of a breed. For example, there was a time when Galloway cattle were increasing in number in the United States, and during that time Galloway cattle breeding was profitable. At present this breed is quite uncommon.

PERCENTAGE OF BLOOD

The percentage of blood is used often to express the amount of pure breeding that may be in a grade or a crossbred. A crossbred female mated to a male of a third breed will have an offspring which is 50 per cent of the sire and 25 per cent each of the components of the crossbred female. The Santa Gertrudis bulls founded in the King Ranch are three-eighths Brahman and five-eighths Shorthorn, which of course would be found in an individual having five grandparents of the Shorthorn and three of the Brahman breed. It will be readily seen that this method can be used to express the proportion of the whole inheritance of a grade or a cross and to evaluate an individual in a pedigree.

The percentage of blood idea does not fit into the explanation of unit characters that involve one to three factors. For example, the behavior of horned and polled characters does not lend itself to explanation by the percentage of blood idea, which had its origin in Galton's law of ancestral heredity. The Mendelian law offers a more plausible explanation for the

inheritance of unit characters. For example, the black of the Angus or Galloway is dominant to the red of the Red Poll. The crossbred between these two breeds is not midway between the two breeds in color. In such features as conformation, a



FIG. 72. Model Polled Shorthorn bull, Oakwood Commander, grand champion at the 1940 International Livestock Exposition. Owned by C. B. Teagardin and Son, Ashville, Ohio. (American Shorthorn Breeders' Association.)

cross may be midway between the parents, on the average, because conformation is due to many factors and their interaction.

Breeding Systems

Breeding systems are based upon the closeness of the relationship of the animals mated or on their similarity or dissimilarity in individuality. On the basis of relationship we may have grading up, crossbreeding, and inbreeding, which involve the closeness of the relationship of the individuals mated. On the basis of resemblance we may mate those which appear to be alike or those which are unlike. This is assortative mating or a form of selection.

Inbreeding or the mating of closely related individuals is not done to any great extent in commercial cattle raising. Its use is limited more to purebred herds for the establishment of lines or families, descendants of noted individuals. We do not have in cattle the same situation as exists in commercial corn growing,

where inbred lines are developed which respond favorably when crossed. Commercial corn growers use hybrid seed corn, which usually gives greater yields and greater resistance to wind, disease, and unfavorable conditions than open-pollinated varieties. The inbreeding to form inbred lines reduces vigor and fertility, which can be tolerated in corn because of its greater reproductive rate than domestic animals. Beef herds



FIG. 73. Model Polled Shorthorn female, Queen of Hearts, grand champion female of the 1939 International Livestock Exposition. Owned by Lewis W. Ohlman, Concordia, Mo.

have been developed from the progeny of one sire, but these are rare, and in practice cattle breeders often resort to an outcross in an attempt to gain vigor.

Crossbreeding or mixed breeding preceded the formation of many of our breeds of today, and this was followed in many instances by inbreeding.

GRADING UP

By successive use of purebred sires a herd may be graded up. The amount of blood of the common or scrub stock will be

reduced by the process. It will readily be seen that each use of a purebred sire reduces by one-half the remaining blood of the common stock. The first sire produces offspring of one-half pure breeding if the dam is of scrub breeding. The amount of purebred blood increases successively to three-fourths to seven-eighths to fifteen-sixteenths and so on by the use of purebred sires. The value of the offspring is enhanced over that of the parent roughly by one-half the superiority of the purebred over the grade. It is quite obvious that the amount of improvement is lessened by each step and the high grades are little if any poorer than purebreds. Actually the purebreds in most instances are increasing in merit, and the grades then tend to move upward in merit in the grading-up process in the same manner as purebreds improve. "Grading up" designates the process when confined to one breed. When grade females are mated to a purebred sire of another breed it is crossbreeding.

CROSSING CATTLE OF NONDESCRIPT BREEDING WITH THE BEEF BREEDS

Bulls of beef breeding when mated to cows of nondescript breeding will produce calves that are decidedly higher in quality of beef than those of straight nondescript breeding. This is essentially the grading-up process.

Native eastern Arkansas cattle were crossed with the Aberdeen Angus at the Arkansas Experiment Station.¹ These native cattle showed no evidence of immediate relationship to improved beef breeds and were small sized, hardy, prolific, and accustomed to shift for themselves in large forested areas. During the trial the native cows doubled their weight; poor nutrition was, therefore, responsible for a considerable amount of lack of size. A study was made of the straightbreds, Aberdeen Angus, and native and also the crossbreds and second cross.

The native cows produced weanling calves at a lower cost than the Aberdeen Angus cows or the crosses. This was due to the smaller size of the native cows and the resultant low feed for maintenance requirement. There was practically no difference in the birth weights of the calves, the daily gains and feed

¹ H. E. Dvorachek and Arthur T. Semple, "Beef Producing Qualities of Purebred Aberdeen Angus Cattle Compared with Arkansas Native Cattle," *Bull.* 247, 1931.

requirement for a unit of gain. The purebreds and second crosses dressed slightly higher than the crossbreds and the natives. In grade on foot and in the carcass the purebreds and



FIG. 74. A Hereford bull calf of the right kind, W. H. R. Realistic 5th. Bred and raised by the Wyoming Hereford Ranch, Cheyenne, Wyo.

second crosses ranked first and second, with the crossbreds third and the native a low fourth. The higher selling price of the carcasses from the offspring of the purebred bull made possible a greater return over feed costs.

CROSSBREEDING

Crossbreeding is the mating of individuals that are dissimilar, that is, of different breeds, species, or family. Family crossing is referred to as "outcrossing."

In crossbreeding of beef cattle we may classify the crosses into three groups, (1) breed crosses within the beef type, (2) breed crosses between the beef and dairy type, (3) crosses between beef cattle and other species. They are referred to as hybrids.

1. CROSSES BETWEEN VARIOUS BREEDS OF BEEF CATTLE. These are not commonly made, and experimental evidence upon the behavior of such crosses is lacking. Some breeds were crossed in the formative period, for example, supposedly some Galloway was used with the Shorthorn. Also beef breed crosses have been popular in the beef trade in England. Crosses of the Shorthorn with the Aberdeen Angus and the Galloway will give a blue-gray color which was popular on the English markets. Also some ranchers have crossed the Shorthorn and the Hereford in commercial production.

2. BREED CROSSES INVOLVING DAIRY-TYPE BREEDS. These are not uncommon. When the outlook in dairy production is not favorable, dairymen are tempted to cross their dairy herds with beef bulls. What might be expected from such a cross may be judged from the following investigation.

Discrimination against dairy type steers is mainly because the carcasses that they yield are inferior to those of the beef type steers. The carcass of the dairy type steer is less acceptable to the consumer, consequently they sell lower than beef bred steers, also when offered as feeders or stockers they undersell beef bred steers.

Straight bred Holstein calves were compared with those of straight bred Aberdeen Angus crosses between the two breeds in three trials at the Wisconsin Agricultural Experiment Station.¹ In these tests all the calves were finished at 12 to 15 months at a weight from 900 to 1000 pounds. Following is a tabulation of the average for the three years for the fattening period, which was about 200 days. The calves were allowed to nurse until they were about six months old. Creep feeding of grain was practiced during the nursing period.

The Holstein calves outgained the other group but sold much lower and had a lower carcass yield. This group also made gains on less feed cost than the other group, probably because they did not carry as much fat when the fattening period began. The carcasses of the Holsteins were lacking in flesh over the shoulder blades, ribs, and loin. Also they were uneven in fleshing. The purebred Angus carcasses were smoother in

¹ J. G. Fuller and B. H. Roche, "Fattening Crossbred vs. Purebred Calves for Baby Beef," *Univ. of Wis. Pamphlet*, June 8, 1929.

FATTENING CROSSBRED VS. PUREBRED CALVES
FOR BABY BEEF

	<i>Holstein Calves</i>	<i>Aberdeen Angus Calves</i>	<i>Crossbred Calves</i>
Daily gain	2.37	2.19	2.05
Feed cost for 100 pounds gain	\$11.27	\$12.20	\$13.30
Average selling price	\$10.05	\$13.00	\$12.17
Dressing percentage	59	62	62
Carcass grade			
Prime		8	
Choice		12	12
Good	1	5	8
Medium	22		2
Fair	1		

finish than those of the crossbreds, but differences in the color of fat and lean, marbling of meat, and quality were difficult to detect. In the cooked beef there was no outstanding difference in the quality.

Observations that have been made on crosses made with dairy type and beef type cattle indicate that the beef type characters are dominant in the head and forequarters, while the dairy type characters are dominant in the rear quarters.

3. CROSSES BETWEEN BEEF CATTLE AND OTHER SPECIES. Of the crosses between beef cattle and other species two — those with the Brahman and the American buffalo — are worthy of discussion because of their value in certain environment.

a. Brahman or Zebu Cattle. This is a separate species, *Bos indicus*. These cattle are different anatomically in that they have the hump over the shoulders, large, loose, pendulous dewlap, folds of skin along the under line, a slender whiplike tail, and large pendent ears. In color they vary from a cream or chocolate-brown to black, and the hoofs are black. The bulls roar rather than bellow, and the call of the cow is somewhat like a grunt. They cross readily with the common cattle and the crosses are not infertile. Brahman cattle are resistant to ticks and tick fever. They are adapted to tropical and semi-tropical conditions. High temperature, humidity, and intense sunlight are withstood better by Brahmans and their crosses than by common cattle. In regions of high temperature

Brahmans are especially adapted because of their resistance to diseases and insects and also their hardiness.

There are four principal breeding stocks in the species. They are: (1) Nellore, (2) Gir, (3) Guzerat, (4) Kirishna Valley. Distinctive characters are evident in each of these breeds. As in common cattle, some of these breeds have more pronounced dairy characteristics than others.

*b. Brahman Cattle in United States.*¹ Dr. J. B. Davis of South Carolina in 1849 made the first importation of Brahman



FIG. 75. A Brahman bull, Aristocrat Manso. Owned by J. D. Hudgins, Hungerford, Texas.

cattle (one bull and two cows) to this country of which we have record. He also brought over three bulls from Australia for a Mr. Barrow in 1861. In 1904 A. M. McFadden of Victoria, Texas, bought two head from the Hagenbeck Circus at St. Louis. In 1905 Abel P. Borden imported 51 head of various breeds and colors (gray, white, black and red), of which 33 head were taken to Texas. In 1940 the registration of 4409 head of Brahman cattle was reported by the association.

¹ C. L. Douglas, *Cattle Kings of Texas*, C. Baugh, Dallas, 1939.

c. Brahman Crosses. When used for commercial beef production it is common to limit the amount of Brahman blood to one-fourth or one-half. Cattle of Brahman breeding are common along the coastal region of the Gulf of Mexico from Mexico to southern Florida. A few of the Brahman crosses are raised in other range areas. These cattle usually are sold to the meat



FIG. 76. A noted Brahman cow, Dutchess. Owned by J. D. Hudgins, Hungerford, Texas.

packers from the range, and are seldom fed very heavily on concentrates.

In a study¹ made on the feeding of heavy grain ration to Short-horns and Herefords and crosses of these breeds with the Brahman, it was found that the straight-bred steers were slightly or moderately superior in daily gain, economical use of concen-

¹ W. H. Black, A. T. Semple, and J. L. Lush, "Beef Production and Quality as Influenced by Crossing Brahmans with Hereford and Shorthorn Cattle," *Tech. Bull.* 417, U.S.D.A., 1934.

trates, and appraised value of the carcass per 100 pounds. The steers of Brahman breeding had less shrinkage from feed lot to market and had a significantly higher dressing percentage. The Brahman crossbreds had smaller heads, larger hides, and smaller digestive tracts than the non-Brahman cattle. The carcasses of the Brahman crosses grade lower than those of the beef breeds. If the feeding and management would make possible carcasses that grade good from the beef bred steers, the Brahman beef crosses would grade low good. However, in the comparison of the meat of the Brahmans and non-Brahmans there were but slight differences, and considering the various qualities which affect cooked beef the two kinds were approximately equal in desirability.

d. Crosses of Cattle with the American Bison. Attempts have been made to form a breed by crossing the American bison with domestic cattle. A bison bull is mated to cows and the hybrid¹ is called by some a "cattalo." The cows have physical difficulties in giving birth to the hybrid calves. Also the hybrid males have low fertility. Although the crosses are superior in strength and vigor and may have commercial possibilities, the establishment of such a cross is apparently impractical.

ADVANTAGES OF THE CROSSBREDS

Most of the characters such as size and vigor, which are desirable and contribute to commercial value, are dominant. Crossbreds, therefore, gain from the accumulation of the dominant characters from the strains, breeds, or species crossed. This heterosis is greater in some crosses than others. The crossbred females, because of their greater heterozygosity, may be less useful than straightbreds in the breeding herd.

Breeding Stock Selection

One of the prime essentials in the successful establishment and maintenance of a beef breeding herd is the selection of the individuals which compose the herd. Even in an established herd

¹ Some confusion exists concerning the use of the term. It may be a species cross and it is also used for the offspring of parents unlike one another in one or more characters that are inherited. In corn breeding "hybrid" has still another use, as "hybrid corn" is the product of crossing inbred lines.

the choice of replacements for the individuals being removed demands careful judgment if the merit of the herd is to be maintained or enhanced. The selection of a herd sire is likewise a problem worthy of much consideration as, in the usual herd, where but one sire is used, the sire contributes one-half of the

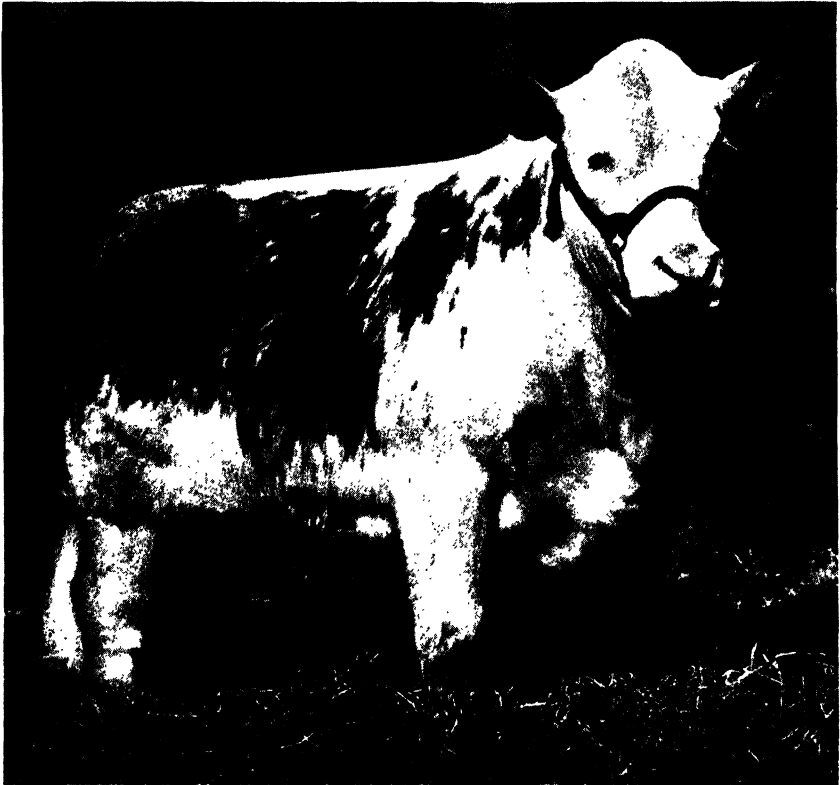


FIG. 77. A crossbred steer. Sired by a purebred Shorthorn bull and out of a crossbred Hereford X Brahman cow.

inheritance to a crop of calves. With beef cattle 40 to 50 per cent of the females and 3 to 5 per cent of the males are needed for replacements to maintain cattle numbers.

BASIS FOR SELECTION

There are three bases for selection in beef cattle: (1) pedigree, (2) production records, (3) individuality. We decide what to

add or to retain in the herd mainly by a study of their breeding performance and appearance. It is quite obvious that all bases should be considered in making a selection, if possible. However, selection is usually based upon individuality or appearance because of the absence of production records and a record of the ancestry.

1. **SELECTION BASED UPON PEDIGREE.** The pedigree may be a valuable and fairly reliable guide in selecting breeding herd members. It may not be a good index of productive capacity because the offspring are not identical with their parents. The sample of inheritance from either of the parents may be average, or by chance above or below average. The usefulness of the pedigree in selection is in supplementing the other bases of selection, that is, individual merit and performance.

2. **SELECTION BASED UPON PERFORMANCE.** The most reliable means of selection is upon actual performance. In beef animals the measurement of performance is difficult. Beef sires and dams that produce offspring that are efficient in feed utilization, rapid gaining, and of desirable carcass quality and proportion are desired by cattle producers and beef consumers alike. The great difficulty is to identify such individuals.

3. **SELECTION BASED UPON APPEARANCE.** A knowledge of the prerequisites of good beef type is essential in the successful management of a beef breeding herd. It is possible to detect actual differences in animals on foot that are related to carcass value. A correlation of $+0.69$ has been found between the grade as feeders and carcass grade. However, as the genotype may not be the same as the phenotype, we are not certain as to the transmitting ability of a beef sire or dam. Certain requirements for breeding herd individuals include the qualities desired in an ideal market steer. For example, a market steer should be wide, deep, compact, and low-set, and we have found from experience that breeding individuals of that same conformation produce their kind rather consistently. That individuals of correct type are produced by individuals deficient in type is the exception rather than the rule. Following are the main items of individuality or appearance which are emphasized in selecting beef type breeding cows and bulls. In form, quality, and fleshing the breeding male and female should be comparable

with the ideal beef steer. These have been discussed in connection with the requirements of an ideal finished steer. Less fleshing is typical of the individuals kept for breeding. Rather than a heavy covering of fat in breeding cattle, a heavy and uniform natural fleshing is desired. Evidence of fat-storing ability is not to be minimized because that quality is demanded in commercial cattle. Natural fleshing is estimated by thickness in the shoulder, crops, and round, or parts where the thickness of fleshing is not masked by a heavy fat covering. In addition to these considerations, in choosing a beef bull or beef breeding cow or heifer, attention is given to the following items: size, breed type, sex character, constitution. Following is a discussion of the requirements of these items.

a. Size. In keeping with our desire for heavy weight for age in beef steers and the credit which weight advantage gives in judging beef steers, we demand heavy weight for age in our beef breeding stock. However, we can have breeding stock that is too large. Late maturity is a consequence of large mature size. Rapid gains are correlated with large size, and rapid gains in most instances are more economical than slow gains. Consequently in our beef herds we want sufficient size to give rapid gains, but this should be consistent with the early maturity market requirement for finished cattle. Big, coarse, rough steers, unfinished at marketable weights, are not in demand on the cattle markets, while small, dwarflike pony steers are not profitable to the feeder.

b. Breed Type. Although conformity to breed characteristics may not be associated with economy of beef production, individuals typical of the beef breeds are desired because of their uniformity.

c. Sex Character. When the bull is approaching maturity attention is given to the development of the secondary sexual characters, as well as the primary sex organs. The maturing bull shows a heavier front quarter, a crest, a heavier head and horn, and a change in temperament. These qualities of masculinity are desired by cattle raisers, as they may indicate virility. Prepotency cannot be estimated by the appearance of masculinity in the males.

Similar changes occur in the growth and development of the

heifer. Femininity is stressed by cattlemen in selecting heifers and cows. In this connection the mammary development is also considered. A beef breeding cow or heifer should produce calves regularly and yield enough milk to give the calf a good start.

d. Constitution. A strong constitution is an important consideration in selecting beef breeding cattle. To the breeder this implies the ability of livestock to thrive under a wide range of conditions.

ADDITIONAL CONSIDERATIONS IN BEEF BREEDING HERD SELECTIONS

Following are some further points to heed in making additions to the breeding herd.

1. AGE. Younger animals have longer periods of expected usefulness. Yet with very young individuals it is impossible to estimate their development. Only with older individuals can breeding ability be appraised.

2. FREEDOM FROM DISEASE. In making herd additions precautions should be taken to prevent the introduction of cattle diseases. Tuberculosis and abortion disease tests and retests serve as safeguards against the introduction of those diseases. The herd from which purchases are contemplated should be investigated thoroughly for health and regularity of breeding.

3. BREEDING HISTORY. When individuals of breeding age are being selected, their breeding history should be examined. Only animals of regular breeding records are worth considering in purchasing beef breeding cows and bulls.

4. RELIABILITY OF THE BREEDER. Purchase of breeding stock should be made from those who have an established reputation for fair dealing. In sales of beef cattle all animals of breeding age sold are guaranteed to be breeders. Cows in calf or with calves at foot are taken as proved breeders and no further guarantee is given. Guarantees are also often made on retesting for tuberculosis and abortion disease.

5. COST, INCLUDING COST OF DELIVERY. All herd additions should represent a forward step in herd improvement. In founding a herd or adding to it, the choice of the individuals is

more important than the cost if it is within reasonable limits. In determining costs the expense of delivery is to be included.

PERFORMANCE TESTING WITH BEEF CATTLE

Milk and butter production can be determined by weighing the milk yielded and testing the butterfat content of the milk. Beef production is not so easily measured. A test to demonstrate differences with beef cattle must measure the efficiency of the gains in weights for a given increase, the value of the carcass, and for comparative purposes the conditions of feeding must be comparable. By means of correction factors for weight and gain differences, allowances may be made for differences in tests, just as the dairyman has an age differential for dairy cows of different ages.

Progeny testing permits estimating the ability to transmit productive qualities by sires and dams. The difference in the progeny of a sire within a beef breed is illustrated by the following data.¹

AVERAGE POUNDS FEED CONSUMED BY PROGENY
TO PRODUCE 100 POUNDS GAIN

<i>Sire No.</i>	<i>Concentrates</i>	<i>Hay</i>	<i>Total</i>
1	504	297	801
2	643	351	994

A difference of 193 pounds of feed is noted in the progeny of the two sires in the feed consumed to produce 100 pounds gain in weight. In all probability as much variation existed in the carcass value. This difference in economy of gain is impossible to predict from the conformation of the progeny.

Apparently it is not necessary to feed out a large number of calves from a sire to determine his breeding ability. Three closely related beef bulls rated on 62 calves did not change materially in their ranking after the first five to ten calves finished the record of performance test.

As both parents contribute equally to the inheritance of a progeny, it is necessary to test for performance not only the sires but also the dams. The fact that a mature sire may be used

¹ Bradford Knapp, Jr., "Performance Testing in Beef Cattle," *Extension Animal Husbandman*, No. 58, June, 1940.

for a herd of 40 to 50 cows when hand mating is practiced (or 50 per cent less under pasture mating) emphasizes the greater influence of the sire.

One of the features which complicates the measurement of the hereditary possibility of an animal is the fact that, in addition to providing 50 per cent of the genes for an offspring, each offspring receives a sample of the inheritance. This explains why full brothers are not identical.

COMMUNITY BREEDING

In beef cattle we seldom find anything comparable to a dairy cow testing association, or a stallion joint ownership group. Among dairy cattle breeders such organizations as bull circles have flourished, while among beef cattlemen they are far less common. The advantages of a community breeding project are apparent. Following is a list of these advantages:

1. It permits keeping sires that are of proved ability as it promotes the exchange of valuable sires.
2. It is usually possible to make selections from the herds in the immediate vicinity with more facts available and at less cost than those made at some distance away.
3. Line breeding without extreme inbreeding can be accomplished.
4. Breeders may acquire information from the experiences of others.
5. Buyers are attracted by the reputation of a community for the breeding stock produced, and more sale stock is available.
6. Advertising, sale expenses, and other business costs of the breeders can be handled cooperatively with lower costs.
7. By pooling resources and joint ownership better sires can be purchased.

In spite of their many advantages, community breeding enterprises and organizations have not become numerous.

Chapter 13

DAIRY CATTLE — GENERAL VIEW

With beef cattle, the main source of income is from the sale of steers, heifers, and cows for slaughter. Dairy cattle, on the other hand, derive their major income from the sale of milk and milk products. However, considerable meat is obtained from dairy cattle, for finally milk cows and dairy bulls are marketed to the slaughterers, and veal calves are largely a dairy by-product. Also, a number of cows that would be classified as beef type are milked. In census reports the division is made, not on type, but on the method of handling; that is, milk cows and those kept for beef. In other words, the reports are based upon the use made, rather than adherence to the specifications of a type.

Distribution of Milk Cows

Milk cows, which in general implies dairy breeding, are more widely distributed on farms and ranches in this country than any other kind of livestock. There is a general demand for dairy products, and the dairy cow has a wide adaptability to climate and crop production. Dairying can be combined quite conveniently with almost every type of agriculture. It is estimated that more than 76 per cent of our farms or ranches keep at least one cow that is milked. The keeping of a milk cow on the farm provides a home supply of essential human food. The widespread use of the farm milk cow is indicated by the fact that more than two and one-half times as many cows and heifers are kept mainly for milk production as are kept principally for beef production.

Dairying and Agriculture

In the permanent settling of our farms, grain farming was first developed, and this was followed by diversification. Dairy farming combined conveniently, and in most instances profit-

ably, with general farming. As a consequence, the place of dairy farming was established in a permanent system of agriculture over the entire United States. Not only was dairying an economical source of nutritive material for human consumption, but it provided a practical means of fertility maintenance. The demand for dairy products, both for the farm and elsewhere, has been on the upgrade. The high nutritive value of milk and its products established by research has caused a great demand for dairy products.

Commercial Dairying Distribution

Commercial dairying is concentrated in certain areas, but home dairying is quite widespread. Farms reporting dairying as their main activity are not generally numerous; in fact, only 11 per cent were so reported in a recent classification. Each agricultural area uses its resources to produce those products for which their production costs are comparatively low. Then, too, since some of the dairy products have a rather high perishability, they are produced near the consuming centers. It is quite apparent that the distribution of the kinds of dairying is related to the agricultural characteristics of the area and its accessibility to markets.

Much change has taken place in dairy practices and in marketing methods. Not so long ago milk was used as fluid milk or made into butter or cheese. These are still important outlets, but more recently several new milk products have been developed and new marketing methods devised. Milk products have been standardized, and butter making and cheese making have been transferred from the farm to the factories. The factory system of dairy manufacture, which is now widespread, has had a marked influence upon the industry. The first cheese factory was established in New York in 1851; the first creamery was started in Iowa in 1871. Distribution and processing of milk has largely been shifted from the farmer to rather specialized groups.

General Methods of Disposition

We readily recognize that the products of dairying or commercial milk may be disposed of as market milk, butter, cheese, or

other dairy products. The farmer may sell the above products to the consumer direct, but processors have largely dominated the butter, cheese, and other dairy products fields. The farmer often leaves even the distribution of milk to a milk dealer or a milk sales agency.

The disposition of milk from the farms by proportion is given in the following data.

DISPOSITION OF MILK PRODUCED ON FARMS IN THE
UNITED STATES, 1940 PRELIMINARY

	<i>Million Pounds</i>	<i>Per Cent</i>
A. Milk fed or consumed on farm where produced		
1. Fed to calves	3,090	2.78
2. Consumed in farm household		
As milk or cream	13,085	11.78
As butter	7,217	6.50
Total used on farms	23,392	21.06
B. Milk sold or utilized for producing dairy products sold from farms		
1. For farm-churned butter sold	1,535	1.38
2. For wholesale deliveries to plants, dealers, etc.		
As cream	33,506	30.17
As milk	45,997	41.41
3. For sales of milk and cream by farmers to consumers	6,642	5.98
Total utilized for products sold	87,680	78.94
Grand total	111,072	

From a survey of the data over a period of years it appears that the amounts used on the farm have varied from year to year, but there seems to be no decided trend. The amount fed calves appears not to have changed materially. A greater amount is consumed as milk or cream and less as farm butter. The amount of farm-churned butter being sold is decreasing. The amount of milk sold as milk for wholesale deliveries to plants, dealers, etc., has increased.

Roughly, about one-fifth of the milk produced is used on the farm where it is produced, and the remaining four-fifths enters into commercial channels.

In the territory adjacent to centers of population market or fluid milk is the main dairy product, and the region is termed the "milk shed." Market cream is usually supplied by an area

farther distant from the population center than the milk shed. Butter, cheese, and other dairy products almost always come from still greater distances. The more concentrated and less perishable products are produced at greater distances from the center of demand.

Farmers' Outlets for Milk

The milk sold from the farm as cream on the butterfat basis or wholesaled as whole milk may reach the consumer in one of the following forms.

FLUID MILK

The fluid milk reaching the large urban centers is produced mainly on the specialized dairy farms. The sanitary conditions pertaining to its production are prescribed by the milk ordinances of the cities in which it is sold. It may be sold as raw milk, which is graded (A, B, and Certified), or as pasteurized milk. It is pooled at plants where it is standardized, pasteurized, and packaged for delivery to the consumer. Market cream for consumption as such is handled in much the same manner. That milk which is in excess of consumptive requirement for fluid milk is termed "surplus" and used for various by-products. It brings a lower return to the producer than fluid milk. Surplus is often termed "manufacturing milk" and is used for butter, cheese, canned milk, and other dairy products. One of the reasons other than seasonal variation for the market milk being in excess of the requirements is the fact that consumption is not uniform from day to day. The purchase of milk is heavier on Saturday and lighter on Sunday and holidays than other days.

BUTTER

Most of the butter manufactured now is churned in modern factories. Very little farm-churned butter is available to the trade. The cream is gathered from the farms by truck and hauled to the creameries. At the creamery, the cream may be divided upon the basis of acidity; the sweet cream is worth a little more than the sour cream. The cream is pasteurized, churned into butter, and packaged for distribution. The process

is carefully controlled and standardized, so the product is of high quality and quite uniform. The present-day butter maker is of necessity technically trained because of the many principles involved in the manufacturing process.

CHEESE

Cheese making has also become a process performed in factories rather than upon the farms. Skilled workmen are essential for the manufacturing and curing of cheese. Much cheese nowadays is processed or blended and reworked so that the process of manufacture is far more complex than when cheese was first made on the farm.

CONDENSED MILK

Since milk has a rather large volume, because of its high moisture content, condensation is often practiced. We may have most of the moisture removed, as in dried milk. A smaller amount of the water is removed from the condensed milk. Such products are less voluminous than milk and can be stored for comparatively long periods of time. Condensed milk may be made from skim milk or whole milk, and it may be sweetened or unsweetened. Unsweetened condensed milk packaged in hermetically sealed cans is termed "evaporated milk." The consumption of evaporated milk has been on the upgrade, while that of condensed milk has declined.

OTHER DAIRY PRODUCTS

Milk is also used for a group of other products — ice cream, casein, lactose, lactic acid, dried whey, etc. Some of these are main products from milk while others are by-products. Many new and useful products are being developed from milk.

The Dairy Areas

The dairy belt extends from New England, including New York, southeastern Pennsylvania, and central Maryland, across northeastern Ohio to Michigan, Wisconsin, southeastern Minnesota, northern Illinois, and eastern Iowa. Heavy populations of dairy cows are near densely populated areas. The distribu-

tion of milk cows and heifers being kept for milk cows is shown in Figure 78.

Southern Wisconsin has the heaviest population of milk cows per square mile. In these specialized dairy areas fairly large herds are kept, while elsewhere the herds are relatively small.

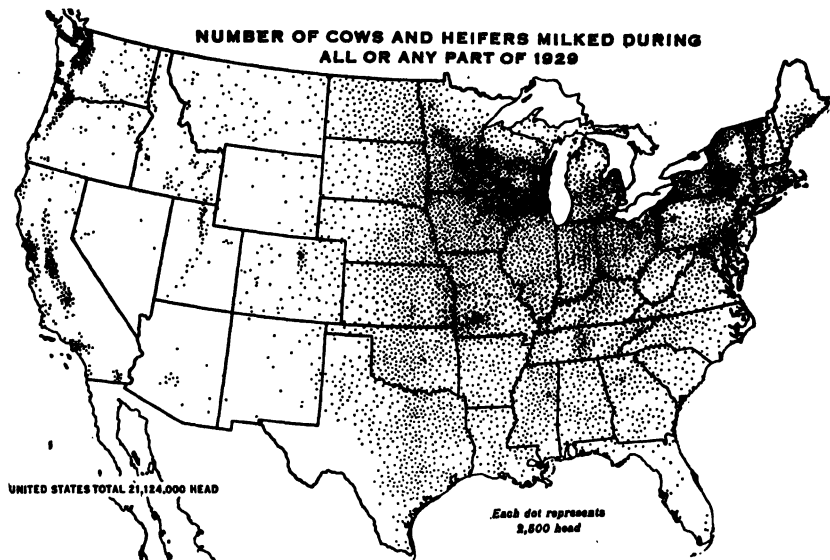


*FIG. 78. Distribution of milk cows in the United States. Milk cows and dairy heifers are most numerous in the dairy belt and near large centers of human population. (U.S.D.A., Misc. Pub. 269.)

Leading States in Milk Production

Milk production is not directly proportional to the number of cows milked, as the level of production is variable. Areas in which herds are small have tended to have the lowest production per cow.

It will be noted that in cows milked and milk produced the states do not rank the same. Iowa, for example, is third in number of cows milked, but New York ranks higher than Iowa in milk produced. The ten states listed above had 53 per cent of the cows milked in the country and produced 57 per cent of the milk. There is shifting in rank from year to year among the states that are close together in numbers and production.

LEADING STATES IN NUMBER OF COWS MILKED (1939) AND
THE MILK PRODUCED IN THOSE STATES, 1940 CENSUS

State	Cows Milked, Thousand Head	Milk Production, Million Gallons
Wisconsin	2,024	1,322
Minnesota	1,552	867
Iowa	1,293	653
New York	1,270	838
Texas	1,147	475
Illinois	984	528
Ohio	933	497
Michigan	867	523
Missouri	823	331
Pennsylvania	796	493
Total for 10 states	11,689	6,527
Total for U. S.	21,937	11,508

The states of Kansas, Oklahoma, Nebraska, Indiana, and California also rank high in numbers of milk cows.

Dairy Cattle and Human Population

The number of dairy cows has tended to increase with more or less regularity with the growth of human population, but has

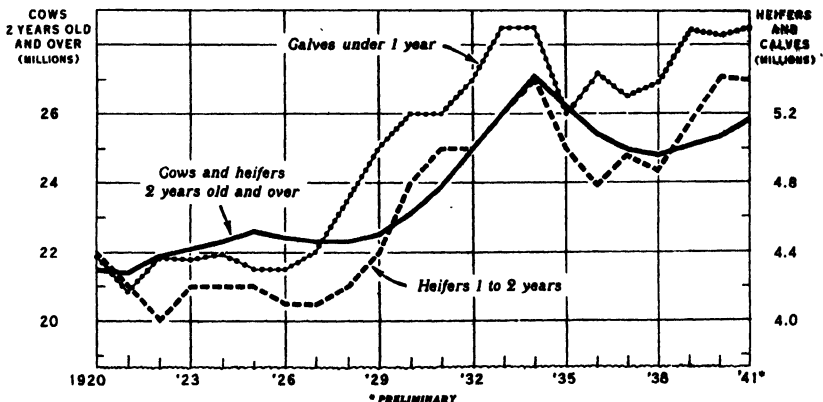


FIG. 79. Milk cows and heifers and calves being kept for milk. Milk cows have tended to increase with the exception of periods of liquidation because of droughts and feed shortages. (U.S.D.A., Bur. of Agri. Economics.)

grown less rapidly than population growth. We have about 0.2 milk cows for each person in the country, whereas up to 1890 we had about 0.25. In other words, the number of persons per

cow is greater than it used to be. This is offset in part by greater production per cow. Since 1900 the number of cows per capita has remained fairly stable except in the feed shortage years following severe droughts. Beef cattle, on the other hand, have shown no decided trend in numbers, but they are subject to more violent fluctuations than milk cows.

The increase in milk cows is shown in Figure 79. Even though droughts and feed shortages have caused liquidation of milk cows and heifers kept for milk, the tendency has been upward. It will also be noted that the number of heifers and calves kept for milk is comparatively high, equaling about two-fifths of the cows being milked. Since the productive period of the milk cow on the average is comparatively short, the replacement rate is very high and many of the calves are kept to go in the herd. The surplus calves are sold as veal calves.

Relative Numbers of Different Breeds

About 60 per cent of the registered purebred cattle were classified as dairy cattle.¹ Of the different breeds the Holstein-Friesian led in numbers, followed by the Jersey, Guernsey, Ayrshire, and Brown Swiss in the order named. In the number registered for the 1930-1939 period,² the order is the same as the standing indicated above with the exception that the Guernsey registrations outnumber the Jerseys. Registered purebreds were not enumerated separately in the 1940 census.

Beef from Dairy Cattle

All cows that are milked are not of dairy type conformation. As the characters for each type are quite antagonistic, the highly developed dairy cow has the least acceptable beef carcass. In the meat trade dairy cattle compete with beef cattle, especially in the cow beef class. About one-half of the beef supply of the United States is derived from cattle of the dairy breeds, and nearly all of our veal comes from calves of dairy breeding. Meat packers have been able by processing to improve the eating properties of beef from dairy cattle, but it cannot be made comparable to that from cattle of beef breeding. Beef from

¹ 1930 census.

² *Agricultural Statistics*, 1940, p. 426.

the dairy cows which is so poor that it cannot be used for block beef is disposed of as meat specialties, such as bologna.

Some dairy breeds rank higher than others in their beef value. Some will fatten quite readily when put on a fattening ration and may carry a fair degree of finish. The fat of the Jersey and the Guernsey has a high yellow color which is objectionable in beef.

Value of Milk Cows and Slaughter Cattle¹

Based upon the prices received by farmers, the average milk cow is worth the equivalent of a 1480-pound cutter and canner cow on the Chicago market for the period 1910-1940. This was



FIG. 80. Dairy cows on pasture. Good pasture provides economical feed for dairy cattle.

equivalent to what farmers were receiving for an average 936-pound animal for beef. It is apparent that the relationship changes with the demand for milk and beef.

When the outlook is favorable for dairying, herds are ex-

¹ *The Agricultural Situation*. U.S.D.A., July 1, 1941.

panded in numbers; the reverse happens when dairying is unprofitable. In the same period of time, that is 1910–1940, a milk cow was equivalent in price to what farmers were receiving for 180 pounds of butterfat, or 2930 pounds of milk (wholesale). Of more concern to the farmer producing milk is the price ratio between the product and the feed, because the milk and butterfat is the form in which the dairyman markets feed. The milk cow, or 180 pounds of butterfat, or 2930 pounds of milk, was equivalent to 4650 pounds of feed grain or 5.3 tons of hay in price received by the farmer.

With the above relationship of prices, when the average milk cow is worth \$60, and average cattle for beef \$6.23 per hundredweight on farms, a cutter and canner cow would be selling for about \$4.08 per hundredweight on the Chicago market.

Show Classification of Dairy Cattle

The classification of dairy cattle is somewhat simpler than that of beef cattle since it includes only breeding cattle. Individual and group classes are provided. In the former we have usually six classes for bulls and seven for females. In the 1941 premium list for the Iowa State Fair the following classes are given:

BULLS

- Bull, four years or over.
- Bull, three years, under four.
- Bull, two years, under three.
- Bull, 18 months, under two years.
- Bull, one year, under 18 months.
- Bull, four months, under one year.
- Senior champion bull, two years and older.
- Junior champion bull, under two years.
- Grand champion bull.

FEMALES

- Cow, five years or over.
- Cow, four years, under five.
- Cow, three years, under four.
- Heifer, two years, under three.
- Heifer (not in milk) 18 months, under two years. Those calving after 24 months actual age may enter as two year olds.

Heifer (not in milk) one year, under 18 months.

Heifer, four months, under one year.

Senior champion female, two years and older.

Junior champion female, under two years.

Grand champion female.

Get of Sire. To consist of four animals any age, the get of one sire, not more than two of which may be bulls. Get need not be owned by exhibitor.

Produce of Cow. To consist of two animals any age, either sex, the produce of one cow. Produce need not be owned by exhibitor.

Dairy Herd. To consist of four cows two years old or over that have freshened, at least two to be in milk, all to be owned by one exhibitor.

Young Herd. One bull under two years; two heifers, one year, under two; two heifers, under one year. All owned by, and females to have been bred by, exhibitor.

Dairy cattle classifications are not standardized. Livestock shows publish premium lists or classifications which give the classes as well as the other rules and regulations.

Chapter 14

DAIRY TYPE

The dairy type differs from the beef type mainly in the amount of fleshing in the females and the mammary development. As previously pointed out, beef cows and dairy cows are quite similar in internal anatomy and skeletal structure. The correct type in the different dairy breeds has been set forth in the representations of the true type or the ideal cow for each breed. These different models are quite similar since they combine all the dairy characteristics plus the distinctive features of the breed. The models serve as ideals or standards of perfection, for each is a composite of the many desirable characteristics which form the basis for selection or judging. They have been exceedingly helpful to all interested in the breed.

General Characteristics of the Dairy Type

Angularity of form is typical of the dairy type. The three wedges can be observed in the dairy cow of the approved form or type. 1. As viewed from the side, the top line and the bottom line if extended would form a wedge. 2. As viewed from the front, lines along the sides of the shoulders would come to an apex over the withers and spread apart as they pass down the shoulders to the floor of the chest. 3. Looking down upon the top of the cow, a wedge is also observed which has its apex over the withers and its maximum width over the hook bones. This is quite a contrast as compared with a typical beef animal, in which squareness of form is emphasized as well as straight parallel lines. The fleshing which characterizes the beef animal is also somewhat lacking in the dairy cow. In fact, excess fleshing is regarded as a fault in a dairy cow. It should be pointed out that a thin cow may not be a dairy cow, and also there is much variation in the flesh of a dairy cow, which is associated with the stage of lactation. A good dairy cow may

be well fleshed when heavily fed during the dry period and still not assume the form of a beef cow.

The great difference in the natural muscularity of the two types is shown in Figure 17. The carcasses shown in this figure are from very young calves about one week old when slaughtered, so feeding has not altered the shape. The difference in the thickness of the back loins, round, and other flesh parts is due to inheritance.

Basis of Selecting Dairy Cows

Form, type, or general appearance is but one of the bases of dairy cow selection. The dairyman also has the pedigree or the records of the parents, and the performance record of producing individuals in milk and butterfat may be available. In practice, all of these means are used to decide what should be kept or added to the breeding herd. Following is a discussion of selection according to the different bases.

PRODUCTION RECORDS

High producers are generally more profitable than low producers, and the best way to distinguish between the two is to measure the production. This is the most reliable means of predicting future production. A lactation record is but one expression of a cow's ability to produce, and subsequent records may vary from the first. Then too there may be circumstances which would affect one record and not another. Such very tangible factors as feeding, care, times milked per day, and physical condition may materially affect the milk and butter yield in a lactation period. Consequently, in interpreting records the conditions under which the record was made should be considered.

Production records are highly reliable for predicting, but in their absence selections must be made on the basis of pedigree, production of the parents, or the individuality or general appearance.

In the management of a dairy herd the continuance of an individual cow in the herd should be based upon her production. If she is not yielding a reasonable profit over and above feed

and other costs, neither pedigree nor conformation should cause her retention.

PEDIGREE

The parents are listed in the pedigree; the descendants are known as the progeny. Mere statement of the names of the parents or the offspring may have little meaning. Actual records are, of course, necessary to evaluate a progeny test. The pedigree is not an infallible measure of an individual's productive capacity because the pedigree does not indicate the inheritance which was passed on by the parents.

Herd sires are often selected on the basis of pedigree combined with other means. The pedigree may be a helpful guide to selection.

GENERAL APPEARANCE OR CONFORMATION

It is often necessary to pass judgment upon or select dairy animals upon their physical appearance alone. Certain characteristics that are rather typical of high production in dairy cows are considered in making such selections. This is not an accurate method of determining the productive ability of the dairy cow. Differences between high producers and low producers are often evident in the conformation, yet all cows of relatively good dairy type may not be highly productive.

The approved dairy type is the result of breeding and selection to perpetuate a certain form or conformation. Individuals which did not come up to the usual standard set for approved type were discarded, and those which met the requirements won in the show ring and were in demand for breeding. Experience has shown that this conformation is not always an indication of producing ability. Yet when type is scored and compared with production the two appear to be related. Harrison¹ states "Observations on the dairy herd at Cornell University very definitely indicate the importance of correct dairy type. Almost without exception the cows with the highest type score are the highest producers in the herd. The Holstein cows that would classify as 'excellent' and 'very good' have an average production of 819 pounds of butterfat compared to an average of

¹ Edwin S. Harrison, *Judging Dairy Cattle*. Wiley, New York, 1940.

604 pounds of butterfat for the cows that would classify as 'good.' " In the Jersey breed the individuals are placed in 6 groups in the classification of herds. Production records, either Record of Merit or Herd Improvement Record, were available on about 5990 of the 10,363 cows classified up to March 31, 1941. Following is listed the average mature production of each group converted to a mature 365-day equivalent basis.

<i>Classification Group</i>	<i>Average Mature Production of Each Group — Pounds Butterfat</i>
Excellent	642
Very good	614
Good plus	596
Good	559
Fair	550
Poor	533

As the scale of classification increased it was accompanied by an increase in the actual production of the cows. It may be impossible to actually predict production by physical appearance, but apparently it is related to production and can be used in grouping individuals. In several of the dairy cattle breeds, herds may be officially scored or rated on type and the individuals classed into groups.

Detailed Description of the Ideal Dairy Type

THE DAIRY COW SCORE CARD

The score card is helpful in teaching the desired conformation of the dairy cow and the relative importance of the different parts. It is a condensed description of the ideal conformation. Breeders of dairy cattle have long used the score card not only for the description of the ideal type but also for breed type. The different parts of a dairy cow are illustrated in Figure 81.

SUGGESTED STUDENT SCORE CARD FOR A DAIRY COW

A dairy cow of any of the breeds is the subject of the score card adopted by the American Dairy Science Association in 1922. This score card is somewhat different from those for other livestock in the general divisions. Instead of using general appearance, head and neck, body, and hindquarters, the main divisions

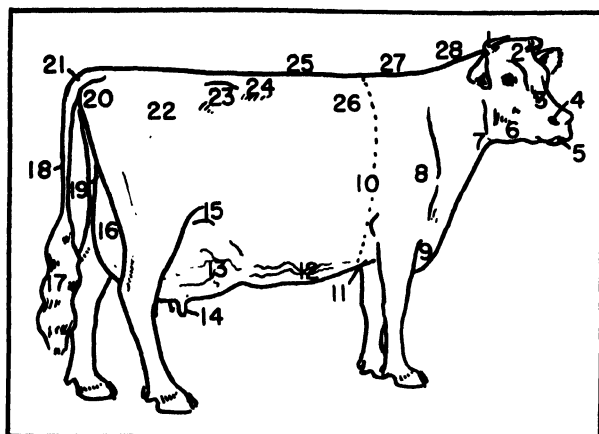


FIG. 81. Parts of the dairy cow.

- | | | |
|-------------|---------------------------|------------------|
| 1. Horn | 10. Heart girth | 20. Pin bones |
| 2. Forehead | 11. Chest floor | 21. Tail setting |
| 3. Face | 12. Mammary veins | 22. Thurl |
| 4. Nostril | 13. Fore udder | 23. Hook bone |
| 5. Muzzle | 14. Teat | 24. Loin |
| 6. Jaw | 15. Rear flank | 25. Back |
| 7. Throat | 16. Rear udder | 26. Crops |
| 8. Shoulder | 17. Switch | 27. Withers |
| 9. Brisket | 18. Tail | 28. Neck |
| | 19. Rear udder attachment | |

are classed into characteristics indicating: (1) dairy form, (2) constitution, vigor and condition, (3) ability to consume and digest feeds, (4) well-developed milk secreting organs. These main divisions are further subdivided into the component parts and values are assigned to each part.

This score card has been very useful in setting the requisites or characteristics of dairy type. Simplification of the scale of points and the evaluating of the defects were suggested by Dean H. H. Kildee. In response to these suggestions, score cards were revised, values were given to the major divisions, and defects were evaluated. These changes are being taken up in other kinds of livestock.

A composite dairy cow score card became available in 1942, it being approved by The Purebred Dairy Cattle Association. The score card is given below followed by the characteristics of the different breeds and the guide to evaluation of defect in judging cows. The ideals of type and breed characteristics

must be considered in the application of the terminology of this score card.

DAIRY COW SCORE CARD

(Based on Order of Observation)

I. GENERAL APPEARANCE

(30 points)

Attractive individuality, revealing vigor, femininity with a harmonious blending and correlation of parts; impressive style and attractive carriage with a graceful walk.

BREED CHARACTERISTICS (see below)

HEAD medium in length, clean cut; broad muzzle with large open nostrils; lean, strong jaw; full, bright eyes; forehead broad between the eyes and moderately dished; bridge of nose straight; ears medium size and alertly carried.

SHOULDER BLADES set smoothly against chest wall and withers, forming neat junction with the body.

BACK strong and appearing straight with vertebrae well defined.

LOIN broad, strong, and nearly level.

RUMP long, wide; top line level from loin to and including tail head.

HIPS wide, approximately level laterally with back, free from excess tissue.

THURLS wide apart.

PIN BONES wide apart and slightly lower than hips, well defined.

TAIL HEAD slightly above and neatly set between pin bones.

TAIL long and tapering, with nicely balanced switch.

LEGS wide apart, squarely set, clean cut, and strong with forelegs straight.

HIND LEGS nearly perpendicular from hock to pastern. When viewed from behind, legs wide apart and nearly straight. Bone flat and flinty, tendons well defined.

Pasterns of medium length, strong, and springy. Hocks cleanly molded.

FEET short and well rounded, with deep heel and level sole.

2. DAIRY CHARACTER

(20 points)

Animation, angularity, general openness, and freedom from excess tissue, giving due regard to period of lactation.

NECK long and lean, blending smoothly into shoulders and brisket; clean-cut throat and dewlap.

WITHERS well defined and wedge-shaped, with the dorsal processes of the vertebrae rising slightly above the shoulder blades.

RIBS wide apart. Rib bone wide, flat, and long.

FLANK deep, arched, and refined.

THIGHS incurving to flat from the side; wide apart when viewed from the rear, providing sufficient room for the udder and its attachment.

SKIN of medium thickness, loose, and pliable. Hair fine.

3. BODY CAPACITY

(20 points)

Relatively large in proportion to size of animal, providing ample digestive capacity, strength, and vigor.

BARREL deep, strongly supported, ribs wide apart and well sprung; depth and width tending to increase toward rear of barrel.

HEART GIRTH large, resulting from long, well-sprung fore ribs, wide chest floor between front legs, and fullness at the point of elbow.

4. MAMMARY SYSTEM

(30 points)

A capacious, strongly attached, well-carried udder of good quality, indicating heavy production and a long period of usefulness.

UDDER — **CAPACITY AND SHAPE**, long, wide, and of moderate depth. Extending well forward, strongly attached, reasonably level floor. Rear attachment high and wide. Quarters evenly balanced and symmetrical.

TEXTURE soft, pliable, and elastic. Well collapsed after milking.

TEATS uniform, of convenient length and size, cylindrical in shape, free from obstructions, well apart and squarely placed, plumb.

MAMMARY VEINS long, tortuous, prominent, and branching, with numerous large wells. Veins on udder numerous and clearly defined.



FIG. 82. The true type Holstein-Friesian cow. (Holstein-Friesian Association of America.)

The breed characteristics referred to on page 233 are listed below:

AYRSHIRE CHARACTERISTICS

COLOR — Red of any shade, mahogany, brown, or these with white, or white, each color clearly defined. Distinctive red and white markings preferable; black or brindle markings strongly objectionable.

SIZE — A mature cow in milk should weigh about 1150 pounds.

HORNS — Inclining upward, small at base, refined, medium length, and tapering toward tips.

BROWN SWISS CHARACTERISTICS

Strong and vigorous. Extreme refinement not desired. Size and ruggedness with quality desired.

COLOR — A shade of brown varying from a silver to a dark brown. Hair inside ears is a lighter color than body. Nose and tongue black, with a light-colored band around nose. Color markings which bar registry are: white switch, white on sides, top, head, or neck and legs above knees or hocks. White on belly or lower legs objectionable.

SIZE — A mature cow in milk should weigh about 1400 pounds.

HORNS — Inclining forward and slightly up. Moderately small at base, medium length, tapering toward black tips.



FIG. 83. The ideal type Guernsey cow. (Guernsey Cattle Club.)

GUERNSEY CHARACTERISTICS

COLOR — A shade of fawn with white markings clearly defined, black or brindle markings objectionable. Skin should show golden yellow pigmentation. When other points are equal, a clear or buff muzzle will be favored over a smoky or black muzzle.

SIZE — A mature cow in milk should weigh about 1100 pounds.

HORNS — Inclining forward, small and yellow at base, refined, medium in length, and tapering toward tips.

HOLSTEIN CHARACTERISTICS

COLOR — Black and white markings clearly defined. Color markings which bar registry are solid black, solid white, black in switch, black belly, black encircling

leg touching hoof, black from hoof to knee or hock, black and white intermixed to give color other than distinct black and white.

SIZE — A mature cow in milk should weigh about 1500 pounds.

HORNS — Inclining forward, incurving, small at base, refined, medium length, and tapering toward tips.

JERSEY CHARACTERISTICS

COLOR — A shade of brown, fawn, or black, with or without white markings.

SIZE — A mature cow in milk should weigh about 1000 pounds.

HORNS — Inclining forward, incurving, small at base, refined, medium length, and tapering toward tips.

The defects of dairy cows are evaluated as indicated in the following tabulation:

GUIDE TO EVALUATION OF DEFECTS IN JUDGING COWS

EYES

1. Total blindness: Disqualification.*
2. Blindness in one eye: Slight discrimination.

PARROT JAW

Slight to serious discrimination.†

SHOULDERS

Winged: Slight to serious discrimination.

CAPPED HIP

Slight discrimination.

WRY TAIL

Serious discrimination.

LEGS AND FEET

1. Marked lameness — apparently permanent and interfering with normal function: Disqualification.
2. Lameness — apparently temporary and not affecting normal function — bucked knees, crooked hind legs, weak pasterns: Slight to serious discrimination.
3. Enlarged knees: Slight discrimination.

ABSENCE OF HORNS

An animal that has been cleanly and neatly dehorned, and whose head shows true breed character: No discrimination.

LACK OF SIZE

Slight to serious discrimination.

UDDER

1. One or more blind quarters: Disqualification.
2. Abnormal milk (bloody, clotted, watery): Possibly disqualification. A slight to serious defect.
3. Udder definitely broken away in attachment: Serious discrimination.

* In a show ring, disqualification means that the animal is not eligible to win a prize. Any disqualified animal is not eligible to be shown in the group classes.

† In slight to serious discrimination, the degree of seriousness shall be determined by the judge.

4. A weak udder attachment: Slight to serious discrimination.
5. One or more light quarters, hard spots in udder, side leak or obstruction in teat (spider): Slight to serious discrimination.

DRY COWS

In case of cows of apparently equal merit: Give preference to cows in milk.

OVERCONDITIONED

Serious discrimination.

TEMPORARY OR MINOR DEFECTS

Blemishes or injuries of a temporary character not affecting animal's usefulness:
Slight to no discrimination.

EVIDENCE OF SHARP PRACTICE

1. Animals showing signs of having been operated upon or tampered with for the purpose of concealing faults in conformation, or with intent to deceive relative to the animal's soundness: Disqualification.
2. Heifer calves showing evidence of having been milked, in an attempt to deceive regarding natural form of udder: Serious discrimination.

SCORE CARD POINTS

The parts of the score card will be discussed separately.

1. **GENERAL APPEARANCE.** In general appearance the dairy cow is quite a contrast from the beef cow. A thin beef cow is not an acceptable dairy cow in form. Attractiveness in individuality and carriage has been stressed in the development of the dairy type. A balance or symmetry of parts is desired which, combined with style, femininity, and vigor, makes for beauty of conformation plus productiveness.

The *breed characteristics* have been previously enumerated. The various features required in the different breeds are not utilitarian qualities, but they constitute breed type. Score cards of the various breeds are available from the different breed record associations. These describe the characters wanted by breeders as well as the requisites of dairy type. A head that is clean cut and shows refinement and femininity is desired on the ideal cow. Coarseness or heaviness of the head and neck are regarded as faulty. The dairy cow head is longer, narrower, and finer than that of the beef cow. Eyes which are quite prominent, moderately large, full and bright, and which denote alertness are desired. A wide face and forehead is suggested. A broad muzzle with open nostrils is required. The jaws should be strong and well muscled. Ears that are of medium size and carried alertly are preferable.

There are distinct breed differences in the head, which may be regarded as minor since they do not detract or add to the dairy character of the head. Horns vary with the breeds, but medium fineness and medium length are wanted in the horns as well as being typical for the breed.



FIG. 84. An excellent Jersey cow, Sir's Standard Bright Beauty, 1940 national grand champion Jersey cow. Bred by H. V. Amason of Rayle, Ga. Owned and shown at the 1940 National Dairy Show by J. L. Hutcheson, Sr., of Greenfields, Rossville, Ga. (Photograph by Harry Strohmeier, courtesy of the American Jersey Cattle Club.)

The shoulder blades are set smoothly against the body and moderately thin at the withers in the model individual. Winged shoulders are definitely objectionable.

a. Back, Loin, and Rump. These are given less emphasis in the dairy cow than the beef cow. This difference of emphasis merely illustrates the divergence of the two types. The dairy type stresses that which goes with milk production, and in the beef cow the back and loin are prime essentials since they yield

high-priced beef cuts. A back that is strong and straight and a loin that is broad and strong are requisites in the ideal dairy form. A rump which is long, wide, level, with a smooth, fine tail setting and thurls wide apart, is called for. Extreme thickness or beefiness of the top such as would be present in a beef cow is not wanted in the dairy cow.

b. Legs and Feet. The front legs and also the hind legs are

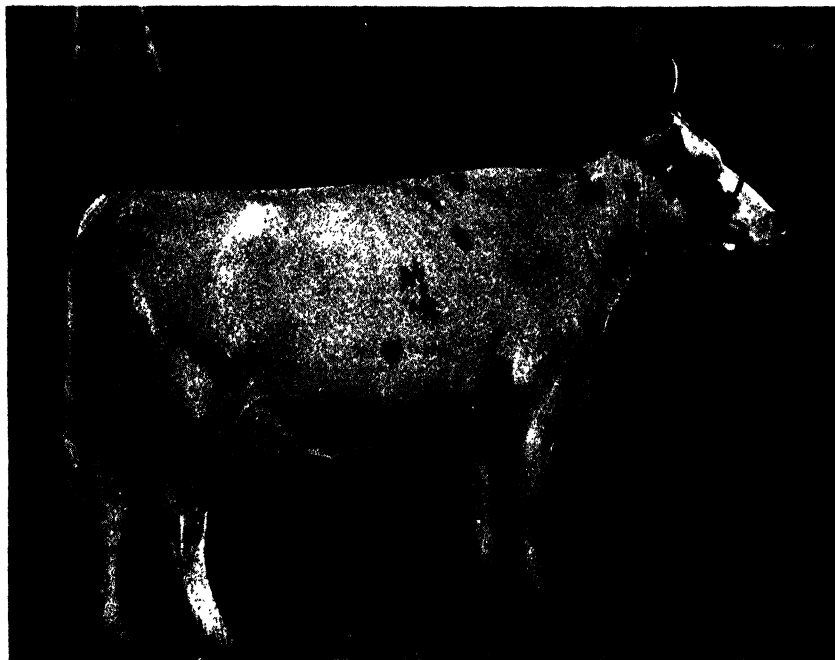


FIG. 85. An excellent Ayrshire cow, Alfalfa Farm Ann 2nd. A grand champion cow, and also a winner in the milking contest, Eastern States Exposition. (Ayrshire Breeders' Association.)

to be well set and fairly wide apart. Legs that are straight and medium length are preferred. A bone of ample size and free from coarseness, including the joints, is stressed. A dairy cow cannot perform satisfactorily under average conditions unless she has ample underpinning. Cows are kept to convert pasture, as well as other feed, into dairy products. Good feet and legs are requisites for the ability to graze. Hocks carried close, and knees that are too close together, are rather common in dairy cows. The former is objectionable because such confor-

mation interferes with normal rear udder development. Narrowness in front is associated with a lack of chest capacity and resultant impaired vigor.

2. DAIRY CHARACTER. In estimating the dairy character the time of the lactation period is to be considered. In general, angularity and freedom from excess fleshing are stressed.



FIG. 86. A model Brown Swiss cow. (Brown Swiss Breeders' Association.)

A clean-cut, lean, fairly long *neck* which blends smoothly into the shoulders and brisket is desired. The withers in the dairy cow are sharply defined as they form the apex to the wedge or angular conformation. Heavy fleshing or coarseness of the withers is objectionable. One of the indications of the general openness of conformation suggested for the dairy cow is the width between the ribs. Wide, flat, and long ribs are desired.

The *thighs* are very different from those of the beef cow in that they are flat and lean rather than thick and plump. As the udder is of primary importance, the thighs should not interfere with its size or attachment.

The skin is given attention in selecting dairy cows, and it is required that it be medium in thickness, loose, and pliable. A good hide indicates the condition of nutrition, as its pliability, secretions, and hair are affected by the circulation.

3. **BODY CAPACITY.** A capacious middle or barrel indicates consumptive capacity and ample space for the vital organs. A large body capacity permits the utilization of much feed, and chest capacity is indicative of strength and vigor. The *barrel* that is deep, wide, and increasingly so toward the rear meets the requirement. Further, the middle needs to be strongly supported and with well-sprung ribs that are wide apart. Much emphasis is given to the heart girth on dairy cows. Long, well-sprung ribs, width at the chest floor, and fullness at the point of the elbow will give the large heart girth desired.

4. **MAMMARY SYSTEM.** The characteristics indicating well-developed milk secreting organs constitute the most important part of the score card. A cow may have all of the other qualifications required, but if she lacks in mammary development or a strongly attached, capacious, good-quality udder she is not suitable for the dairy herd. Heavy and persistent production are essential for a profitable dairy cow.

A large-sized *udder* that is high in quality and symmetrically shaped is preferable. It should be long, wide, and moderately deep. A shapely, well-carried udder will stand up under successive lactations. Further, it should extend well forward and be well attached both in front and in the rear. Misshaped udders, that is, those which are pendulous, not evenly balanced or symmetrical, otherwise deformed, will become worse with advancing age. Such conditions may inhibit production.

An udder that is large because of fibrous tissue would be less productive than one composed mainly of secretory tissue. A high-quality udder is one that is soft, pliable, elastic, free from excess fibrous tissue, and high in secretory tissue. Such an udder will be well collapsed after milking.

Milk veins are also stressed in judging cows, and those that are large, long, crooked, and branching are preferable. Noticeable milk veins on the udder are also wanted. Large *milk wells* are likewise desired. *Teats* that are convenient in size, uniform, well placed, and shapely are essential for ease in milking.

The Dairy Bull

The qualities that are wanted in the dairy cow are also desired in the herd sire, yet the dairy bull is rarely selected on individuality alone. Since the value of a herd sire is determined by the individuality of the offspring and their productiveness, it is no wonder that all considerations which might be helpful in his selection are used. The pedigree and the productiveness of his ancestry are valuable aids in making a choice of a bull.



FIG. 87. The true type Holstein-Friesian bull. (Holstein-Friesian Association of America.)

There is great diversity of opinion as to just what constitutes the correct type in the dairy bull. The bull's individuality is certainly less reliable in predicting what he will sire than the estimated production from external characters in cows. The value of a sire is known only when his heifers are in production.

Since there is relationship between the individuality of a sire and that of his produce, we have true type models of dairy bulls as for cows. In general, bulls showing angular dairy form are

preferred to smoother bulls less angular and more of the thick, fat kind.

GENERAL APPEARANCE

In general appearance the dairy bull should be representative of the breed in all respects; also vigor, masculinity, attractiveness, and balance or symmetry are demanded. Size should be ample, breed differences considered. The head that is definitely



FIG. 88. The ideal type Guernsey bull. (American Guernsey Cattle Club.)

masculine, clean cut, moderately long, and wide, and which is broad at the muzzle, with open nostrils, is specified. Lean, strong jaws and fairly large, bright eyes are preferable. The ear should be medium in size and well carried. Horns, if present, should be medium in size and not too spreading.

A strong, straight back that is fairly wide and long is required in the model as is a loin that is broad and level and a rump that is long, wide, and level. Width is stressed in the hips, thurls, and pin bones. The tail head should be neat and well carried. A

tail that is rather long and tapering with a well-developed switch is desired.

DAIRY CHARACTER

A typical bull should show evidence of the transmission of milk qualities rather than beef. Angular conformation plus freedom from beefiness is typical of *dairy character*. In this connection we emphasize a long, masculine-appearing neck with



FIG. 89. An excellent Jersey bull, Misty Dawn's Successor, 1940 National grand champion Jersey bull. Bred, owned, and shown at the 1940 National Dairy Show by Hugh Bonnell, Cranberry Run Farm, Youngstown, Ohio. (Photograph by Harry Strohmeyer, courtesy of the American Jersey Cattle Club.)

a moderate crest, smoothly blended with the shoulder, and clean cut. The withers are less sharply defined than in the cow, yet the vertebrae should rise above the shoulder blades and be fairly fine and free from fleshiness. The openness of conformation desired is indicated by the ribs of the dairy bull, which should be wide apart. Plump thighs are not typical of the dairy bull; rather they should be flat, trim, wide apart as viewed from the rear, and well cut up between the thighs. Teats or rudimentaries that are wide apart and well placed are desired.

Testicles that are uniform and normal in size are a requisite. A hide that is medium in fineness, pliable, and loose, with a fine hair coat is wanted.

BODY CAPACITY

A capacity that is great, the size of the bull considered, is demanded. This provides ample space for the consumption of feed, and also denotes strength and vigor.



FIG. 90. An excellent Ayrshire bull, Bois de la Roche Golden Glow, a show bull of note. (Ayrshire Breeders' Association.)

A long, deep, wide barrel and a well-developed heart girth give the capacity requisite for dairy production. Width as well as depth should be stressed for chest capacity.

FEET AND LEGS

Ample underpinning is necessary for ruggedness, vigor, or animation. Squarely set legs that are clean cut and ample in bone are essential for normal activity. The legs should be straight, quite wide apart, medium in length, and the pasterns

strong and springy. A well-developed set of shapely feet is also a requisite.

Dispositions of Dairy Bulls

Dairy bulls are active and often less tractable than beef bulls. Some are rather difficult to handle. Ample equipment is needed



FIG. 91. An excellent Brown Swiss bull, Blankus Baronet of Walhalla.
(Brown Swiss Breeders' Association.)

to handle a dairy bull safely, and they should always be handled with care even though they may appear gentle.

Examination of Dairy Cattle

It has been found to be advisable to study a dairy animal first at some distance away, probably 20 to 30 feet. It is always desirable to move dairy cattle, for faults not observed when an individual is poised or standing usually become more evident when they move. After the individual or class has been made to stand, the student should make a closer inspection from the front, sides, and rear. Lastly, handling is resorted to in order to examine points or parts not discernible to the eye and to

confirm what has been previously observed. Handling permits an estimate of the hide quality and flesh covering.



FIG. 92. Well-developed udders. Cows that rank high in milk production always have large and usually well-developed udders. (From *Dairy Cattle and Milk Production*, by C. H. Eckles.)

shown by an analysis of data concerning 554 dairy herds in New York State.¹ For each 100-pound increase in the size of the dairy cows there was an annual increase of approximately 800 pounds of milk per cow. A tabulation of the data is given on p. 253. The heavy cows produced more milk and had a higher estimated value per cow than lighter cows. The decrease in milk production is quite regular from the heaviest to the lightest. Although the two lightest groups were the youngest, age does not appear related to the size in the

It is also resorted to for the determination of the quality and soundness of the udder, and perhaps to examine the milk veins.

The novice is inclined to be unsystematic in his examination, depending too much upon handling and inspecting the individual at too close range. Many important features are properly appraised at a distance, and close inspection fails to give the proper evaluation to the animal as a whole.

Large Cows Produce More Milk

That large cows are more productive than smaller cows is



FIG. 93. Well-developed milk veins. Large milk veins indicate productive capacity. (From *Dairy Cattle and Milk Production*, by C. H. Eckles.)

¹ *Farm Economics*. New York State College of Agriculture. Cornell University. No. 125. May 1941.

RELATIONSHIP BETWEEN SIZE OF COW, MILK PRODUCTION
PER COW, AND VALUE PER COW

554 Herds in Five New York Counties, 1940

	<i>Average Weight Per Cow, Pounds</i>	<i>Average Milk Produced Per Cow, Pounds 3.7 Milk</i>	<i>Average Estimated Value Per Cow</i>	<i>Average Age Per Cow, Years</i>
1. 10 per cent of herds with heaviest cows	1140	7886	\$109	5.5
2. Next lighter 10 per cent	1061	7614	93	5.6
3. " " " "	1026	6948	88	5.5
4. " " " "	992	6439	84	5.7
5. " " " "	964	6654	87	5.4
6. " " " "	935	6123	80	5.6
7. " " " "	908	5935	82	5.3
8. " " " "	876	5737	82	5.6
9. " " " "	842	5535	76	5.2
10. 10 per cent of herds with lightest cows	792	5070	70	5.0
Range between groups 1 and 10	343	2816	39	0.5
Per cent increase from light- est to heaviest	43.9	55.5	55.7	10.0

other groups. Even though the larger cows may give higher average yields of milk and butterfat, a smaller cow may be more efficient because of low maintenance needs. In selection the production ability rather than size should be emphasized.

Size of Different Breeds

There is a rather large difference in the size as indicated by weight of the common dairy breeds. Based upon the suggested weights for mature individuals, the breeds rank in the order of Holstein-Friesian, Brown Swiss, Ayrshire, Guernsey, and Jersey. In all the breeds there is a wide range of weight; consequently there is considerable overlapping and little difference in the average.

The suggested weights for an average mature individual of both sexes listed below are taken from breed score cards and other sources.

AVERAGE WEIGHT OF MATURE INDIVIDUAL

<i>Breed</i>	<i>Bull</i>	<i>Cow</i>
Holstein-Friesian	2000	1500
Brown Swiss	1850	1400
Ayrshire	1700	1150
Guernsey	1600	1100
Jersey	1500	1000

The above weights are for individuals with the usual amount of flesh. Many will range far above the weights given. Acceptable bulls or cows should not fall markedly under the weights given above. There are advantages and disadvantages of large size. As maintenance requirements are proportional to size, it will require more feed to keep the larger cows. Large individuals are also slower in maturing and may come into production at an older age than the smaller, earlier maturing kind. Size, however, has the advantage of vigor and ruggedness, and the large animals bring more income when sold as beef. Large size also gives greater consumptive capacity and consequent greater productions.

Chapter 15

MILK SECRETION

Milk is synthesized and secreted by the mammary glands in the udder of the cow. This is a characteristic of all included in the zoological class *mammalia*. Milk is produced in the udder of the female following the giving birth to young. Rudimentary mammary glands are present in the male, but these are comparatively small and rarely active. Milk is derived for human use from several species of the *mammalia* class, but the dairy cow is distinctive because of the volume and persistency of her production. In the improvement of dairy cattle, milk production has been the main objective.

The Udder

The mammary glands of the cow are included in the one structure, the udder. It has been previously pointed out that a large udder is a prerequisite for a productive cow. There is an udder shape which is desirable, because the udder should not interfere with locomotion. A well-attached udder will retain its shape and carriage with advancing age. An ideal udder has a level floor and has the teats squarely placed at ample distance apart. The fore udder should extend well forward on the abdomen, and the rear udder should extend well up between the hind legs. The breaking away



FIG. 94. Common udder defects. A well-developed udder is of first importance in selecting any dairy cow. Defects are common in all breeds. (From *Dairy Cattle and Milk Production*, by C. H. Eckles.)

of the udder attachments and relaxing of the median and lateral suspensory ligaments give rise to a pendulous, poorly carried udder. As age advances it becomes more distinctly quartered and pendulous.

The udder of the cow is made up of four quarters, each of which is a mammary gland, and is halved along the median line. The median suspensory ligament separates the halves. The quarters are also separate, as each quarter is independent in secretory tissue and milk ducts. An udder injected with a stain and sectioned will show a definite division between the fore and rear quarters. The division between the quarters on a side is not obvious from external examination, but a distinct groove separates the sides on the median line.

The Internal Structure of the Udder

In the examination of the udder being dissected it will be observed that each half is enclosed in a fibrous capsule, an extension of the suspensory ligaments. Exclusive of the fibrous connective tissue and the overlying skin, there are secretory tissue, a duct system, a blood and lymph system, and also nerves. Each of these will be briefly considered separately. (See Figure 95.)

SECRETORY TISSUE

At the termination of each small milk duct are found three to five saclike structures which are called *alveoli*. A single layer of nucleated epithelial cells line each alveolus, and these cells are responsible for the secretion of milk. On the outside of these are the structural connective tissue, blood, lymph vessels, and nerves. The circulatory system, blood, and lymph provide the materials from which milk is made, and the milk is taken up by the epithelial cells and passed into the lumen or opening of the alveolus. Espe¹ has likened the mammary gland to innumerable bunches of grapes freed from gravity but attached to a hollow trunk system. The grapelike bunches of alveoli form the lobules and the loaded branches, the lobes. The "grapes" are so numerous in the more highly efficient glands that, except for the collecting system or ducts and the blood vessels, practically all

¹ Dwight Espe, *Secretion of Milk*. Collegiate Press, Ames, Iowa, 1941.

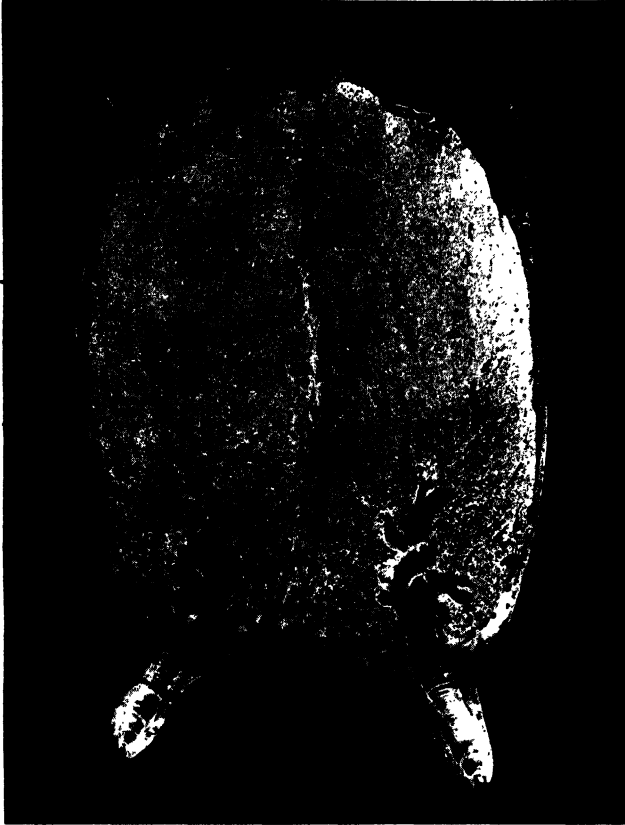


FIG. 95. Vertical transverse section through the rear udder of a lactating Holstein cow. (U. S. D. A., Bureau of Dairy Industry.)

of the available space is occupied by the alveoli and thin connective tissue septa. In less "milky" udders the connective tissue septa are thicker and more pronounced.

DUCT SYSTEM

The duct system has its termination in the teat, and it extends to secretory tissue in the alveoli. The teat is comprised of the connective tissue wall which is covered with skin that is practically hairless and is usually darker colored than the skin on other parts. (See Figure 96.) The central part is a cavity termed the "teat cistern," and this is drained through the streak canal. This canal is from 8 to 12 mm. long and is lined with folds

which close the opening. Sphincter muscles keep the folds pressed together to close the opening. In milking, pressure is applied from the upper part downward, forcing the milk out of the teat.

Immediately above the teat cistern in the body of the udder is the gland cistern. The latter serves for milk storage. The gland cistern is variable, but it generally has a capacity of about a pint. About 12 to 50 rather large ducts enter the gland cis-

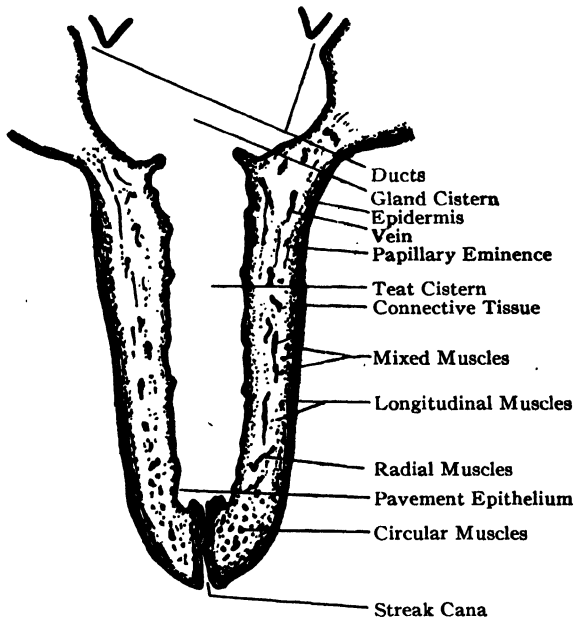


FIG. 96. A longitudinal section of a cow teat and the lower part of the milk cistern. (From *Dairy Science*, by W. E. Peterson, J. B. Lippincott Co.)

tern. Each large duct drains a portion of the gland called a "lobe." The ducts branch into the many small ducts which drain the alveoli.

CIRCULATORY SYSTEM

The udder receives its main supply of blood from an artery to each half. A branch from the iliac artery known as the external pudic artery passes through the inguinal canal to the udder. There are two main branches of this artery in the

udder, the cranial, which goes to the fore quarter, and the caudal, which passes to the rear quarter. The surface circulation is from the general peripheral circulation.

There are three different routes by which the blood may leave the udder. They are the external pudic veins, the subcutaneous abdominal veins, and the perineal veins. The subcutaneous abdominal veins are commonly called the *milk veins*, and they are a continuation of the mammary veins of the udder. The place where the milk veins penetrate the abdominal wall is called a "milk well." The size of milk veins is dependent upon the stage of lactation; consequently, they are the largest at the peak of lactation. The greatest volume of blood is returned to the heart by the milk veins; consequently, they are large in heavy producers. However, since blood may be returned to the heart by other than the milk veins, their size is not a completely reliable index to volume of production. There is also a lymphatic circulation in the udder. The lymph comes from the blood, and then is carried away from the tissue in lymph vessels which join together to form larger vessels. Lymph vessels pass up the inguinal canal and enter the lumbar lymph trunk.

NERVE SYSTEM

The udder is innervated by sympathetic nerves which pass to the udder through the inguinal canal.

Development of the Udder

The tissue from which the udder develops is differentiated quite early in the fetal development. When born, the heifer calf has a well-developed teat cistern and gland. As the heifer grows, the fatty tissue in the udder is replaced by a developing duct system. With pregnancy, there is a very rapid development of the duct system which is practically complete at the end of five months of pregnancy. As pregnancy advances, there is a great growth in the size of the udder, owing to the formation of alveoli. At parturition milk secretion begins.

Hormonal Control of Secretion

Certain hormones have an influence upon the development of the udder. *Estrone*, an ovarian hormone, causes the develop-

ment of the duct system. *Progesterone*, a secretion of the corpus luteum, is responsible for the development of the alveoli and epithelial cells. *Prolactin*, a secretion of the anterior pituitary body, causes a secretion of milk. These three hormones have to do with the growth and functioning of the mammary glands. Each has apparently a very definite function, and they act in a sequence. The mechanism of milk secretion is not understood completely. Lactation is linked with reproduction, and the activities of the organs concerned with reproduction in the female are interrelated with milk production. It is known, for example, that pregnancy in the latter months inhibits milk flow. Oestrus also appears to effect lactation.

As milk production recedes, the udder shrinks in size because of the reabsorption of the alveoli. The alveoli develop again on subsequent pregnancy.

Milk Secretion

Although the structure of the mammary gland has been studied and is quite well understood, we do not understand just how milk is formed. Therefore, we have several theories as to how milk is synthesized. The most widely accepted theory is that, in general, milk is formed by true cell metabolism. In other words, milk is a synthetic product of the epithelial cells in the alveoli. The materials for milk are taken from the blood stream and changed to make the various constituents of milk. Some materials are unchanged in passing through the cell; they are filtration products from the blood. This is largely true of such things as water, minerals, and vitamins. Milk globulin, one of the milk proteins, is identical with the globulin found in the blood. On the other hand, such substances as the milk proteins, casein, and lactalbumin have for their precursors the amino acids in the blood, which are synthesized into proteins by the cells. Milk then contains some quite complex materials that are not found in the blood but are elaborated from the blood constituents. While the secretion of milk is mainly a matter of cellular metabolism, normal milk contains the products of cell degeneration and also infiltration products from the blood.

Time of Milk Secretion

Milk secretion is a continuous process, that is, there is no rapid increase in secretion during the act of milking. The milk drawn at a regular period of milking is in the udder at the time. An udder removed from a slaughtered milk cow would give the normal amount of milk.

As milk is secreted in the udder, there is an accumulation of pressure which causes a decrease in the rate of secretion. If an udder is not milked there may be resorption of the secreted milk. The fact that udder pressure affects milk secretion explains why it is necessary to milk high-producing cows more than twice per day.

Holding Up Milk

Cows that have become excited may "hold up" their milk. It has been found that the ability to hold up milk is not voluntary. Letting down of milk is a reflex action which is probably due to some hormone that affects the muscle fibers in the udder. The suckling process by a calf causes the milk to be let down, which is also true of other conditions incident to milking. Hand manipulation of the teats and udder, for example, influences the letting down of the milk. One explanation of letting down of milk is that the udder becomes distended with blood, forcing the milk out of the alveoli. A more logical one is that the milk is forced out by muscular contractions.

Upon milking, a small amount of milk can be quickly drawn, after which there is a period in which milk is not so readily drawn. This latter period is the time of "holding up the milk," and it is followed by a period in which milk flows more readily into the milk cisterns and is more easily drawn.

Nature of Milk

Milk is a secretion of the normally functioning mammary gland. It is a very complex material and contains some rather complex substances. It is the natural food for young mammalia; consequently, it must contain the many needed nutrient materials in order to be adequate. Milk is regarded as being our best single food; however, it is not without nutritive inadequacies.

Milk contains sizable quantities of protein, fat, lactose and mineral matter. It also contains small amounts of the vitamins, pigments, enzymes and other organic compounds.

Milk is opaque and ranges in color from bluish white to yellowish white. It has a sweetish odor when freshly drawn. The taste is sweet. Fresh milk is very slightly acid, having a pH of 6.5 to 6.6. It is amphoteric to litmus paper, that is, it will turn red litmus blue and blue litmus red. Feeds may influence both the odor and the taste of milk.

The water in milk forms the continuous phase in which materials are held in solution. Sugar or lactose of milk, as well as some of the minerals, albumin, and globulin, are in true solution. There is also a colloidal phase which includes some of the protein compounds in the form of minute particles. Further, there is a suspension phase, which includes the fat globules, particles of microscopic size. The specific gravity of milk ranges from 1.026 to 1.034, the average being about 1.032 at 15°C.

Composition of Milk

The composition of milk varies with the breed and the individual. It may be affected by such factors as the condition of the cow, stage and period of lactation, environment conditions, feeding and management. These factors and others affect not only the quality of the milk but also the quantity.

The fat content may vary 30 per cent from day to day, but there is usually less variation in the protein, sugar, and minerals. There may also be a 20 per cent variation in the quantity of milk. As lactation advances, the milk flow declines, the content of fat rises, and the lactose declines.

Between cows there is a great difference in the composition of milk. Therefore, in a comparison of cows the butterfat test is highly important. Much difference exists in the persistency of production. Cows having about the same initial production may show as much as 50 per cent difference in yearly production.

The table from Peterson¹ which follows gives the variation in the composition of cows' milk and also the mean or average composition.

¹ W. E. Peterson, *Dairy Science*. Lippincott, Philadelphia, 1939.

VARIATIONS IN COMPOSITION OF COWS' MILK

<i>Constituent</i>	<i>Maximum Per cent</i>	<i>Minimum Per cent</i>	<i>Mean Per cent</i>
Water	90.32	80.32	87.27
Protein	6.40	2.07	3.55
Casein	6.29	1.79	3.02
Albumin	1.44	.25	.53
Fat	10.00	1.20	3.80
Lactose	6.12	2.11	4.9
Ash	1.21	.35	.71

There is a big difference in the dairy breeds in the composition of the milk from representative individuals. Following is a tabulation of milk composition by breeds.

COMPOSITION OF MILK BY BREEDS

<i>Breed</i>	<i>Total Solids Per cent</i>	<i>Fat Per cent</i>	<i>Protein Per cent</i>
Jersey	14.80	5.36	3.80
Guernsey	14.50	4.96	3.75
Brown Swiss	13.00	4.00	3.50
Ayrshire	13.00	4.00	3.50
Holstein	12.30	3.42	3.30

It will be noted that the breeds giving the least milk have the highest fat and protein content. It appears that, as the fat content of milk increases, the percentage of protein and ash also increases while the lactose content decreases. Of the various ingredients in milk, lactose seems to be the least variable, that is, within cattle and between species.

The Fat in Milk

The fat particles in milk vary in size from 1 to 10 microns in diameter. The Guernsey breed has the largest fat particles, while those of the Ayrshire and Holstein are comparatively small. The fat content does not remain constant during milking. The first drawn milk is lower in fat than that which is drawn last, and fat content also varies from one milking to the next. Of all the constituents of milk, the fat content is the most variable.

There may be seasonal variation in the fat test, for as the amount of milk decreases, the fat content usually rises. Season may affect the feed supply and therefore may change the amount of milk produced. Many other conditions may have the same influence. Fat content of milk is also higher in the winter because of the effect of lower temperatures.

The color in milk is due to the carotenes, fatlike substances; these materials are precursors of vitamin A. Since vitamin A is colorless, milk which is highly pigmented because of its carotene content may not have more vitamin A value than lighter color milk. There is both vitamin A and carotene in milk. Guernseys produce milk and butter high in yellow color or carotene, while the Holstein has the least amount of this substance.

Colostrum Milk

The milk yielded immediately following calving is vastly different from normal milk in composition if the cow has had a rest period prior to calving. This first produced or colostrum milk changes to normal in about ten days' time. It is common to withhold the milk for human food until sometime after calving. Colostrum milk is much higher in total solids than normal milk because of its high protein, mainly globulin, content. Colostrum milk is higher in ash, more variable in fat (0.15 to 12.0 per cent), and lower in lactose than regular milk. Cows milked up until calving yield colostrum less different from normal milk than cows with a precalving rest period. Colostrum milk is somewhat laxative and very high in vitamin A and antibodies, making it particularly beneficial for the new-born calf.

Factors that Influence Milk Yields and Composition

It has been previously indicated that breed and calving affect both the quantity and quality of milk. There are also other conditions which affect milk flow. Some of the more important of these will be discussed separately.

STAGE OF LACTATION

A normal lactation curve based upon the amount of milk produced has been extensively studied. The production increases until about the fiftieth day of lactation, and thereafter a gradual

decline in the milk yield occurs. Much difference is manifest in the continuance of milk flow or persistency of production. The fat production is more constant than the milk yield, because as the yield of milk is decreased, the fat content of the milk is increased. There is also an increase in the protein content after the third month of lactation.

NUMBER OF MILKINGS

Since pressure built up by milk secretion retards secretion, it is apparent that frequent milkings will give a greater production than the usual twice-a-day milking. Since the cost increases with the more frequent milkings, it is not usually practiced except with high producing cows and when market milk is sold.

FEED AND STATE OF NUTRITION

It is quite apparent that inadequate nutrition will have an effect upon the amount and quality of milk yielded. The composition is likewise altered — fat, protein, ash, and total solids increase, but the lactose decreases. A satisfactory ration must contain the dietary essentials and also be sufficient in amount to sustain milk production. The amount and quality of the milk produced is very definitely influenced by the ration fed. Since the specific effect of different feeds and feed constituents upon the quantity and quality of milk is rather completely discussed in some of the text books on dairy cattle listed in the appendix, it will not be included here.

SEASONAL EFFECTS

The seasonal variation in the quantity and quality of milk is influenced by the temperature. Fat content is lowest in August and highest in January and gradually changes from one peak to the trough. Cows calving in the fall normally produce the maximum amount of milk and butterfat. Winter calving is also superior to spring and summer calving, milk and butterfat yields considered.

CONDITION OF THE COW

That the condition of the cow at calving time affects the yield and fat content of milk has been clearly demonstrated. As a

heavily milked cow is in negative nutritive balance when lactating, it is evident that an accumulation of flesh would be helpful in sustaining milk production. A dry period is therefore recommended because increased production follows a dry period of suitable length.

AGE

A cow will attain the maximum production at about seven years of age under normal conditions. At ten years the production begins to decline.

A heifer calving as a two year old will produce from 70 to 77 per cent of her mature production. A three year old with a second calf will yield from 80 to 87 per cent, and a four year old from 90 to 95 per cent of mature production. The age is corrected for in the requirements for the advanced registration of cows.

MISCELLANEOUS FACTORS IN MILK SECRETION

Health is a big factor in milk and butterfat production. For example, mastitis or digestive disturbance may affect milk yields and quality. There are also drugs which inhibit or stimulate milk flow.

Chapter 16

MILK PRODUCTION AND MILK RECORDS

The breeding, feeding, and management of the specialized dairy cow has been directed toward heavy milk production. The costs of feed and other items are increased as production is stepped up; however, it is not directly proportional to the gain in production. With cows that are handled as milk cows, high production is stressed, because it is usually economical and necessary for profit from the enterprise. There is a point beyond which additional production may not be economical, but under most conditions the efficient near-maximum yield is seldom reached. Most cow herds are below the level of most economical production.

Milk Production on Farms

For the ten years 1930-1939 there were on the average 23,931,000 milk cows on farms. Each cow had a yearly production of 4338 pounds, which gives a total of about 103,694 million pounds of milk per year. As this includes all cows that are milked, there are many other than specialized dairy cows in this group. On the basis of our average human population this would be a production of about 838 pounds per capita.¹

Average Milk Production

For the year of 1940, the production of milk per cow was 4575 pounds, testing 3.94 per cent butterfat, giving an annual yield of 180.3 pounds of butterfat.² This preliminary estimate was for 24,276,000 cows, and excludes the milk sucked by calves and milk produced by cows not on farms. The production per cow seems to be increasing. The drought year of 1934 was an exception, but the production in all of the other years has been

¹ 1941 *Agricultural Outlook Chart*, U.S.D.A., Agricultural Marketing Service.

² *Farm Disposition and Income from Milk—1924 to 1940*, U.S.D.A. Agricultural Marketing Service, May 1941.

higher than in 1924, the year of the initial estimate. The heaviest milk-producing cows in 1940 were in the states of California, New Jersey, Rhode Island, and Washington, where the annual production was above 6000 pounds per cow annually. States with relatively low milk production per cow were Louisiana, Mississippi, and Florida, where the annual production was below 3000 pounds per cow per year.

For the conversion of butterfat to butter it is usually assumed that butter is approximately 85 per cent butterfat. On this basis the average milk cow for 1940 yielded about 212 pounds of butter.

Production Needed for Profit

The profit made from dairying lies in the margin between the cost of keep of the cow and the price received for her production. Dairy cows also provide a home market for farm-raised feeds and bring an indirect return through the maintenance of fertility and resultant improved crop yields.

Since considerable expense is involved in the keeping of milk cows, a certain level of production must be maintained. Illinois studies indicate that cows producing 4000 pounds of 4 per cent milk or less during a year yielded no profit. As the yield was extended beyond the 4000 pounds, profit was shown. Since the average production is only slightly in excess of the 4000 pounds, it is apparent that many unprofitable cows are being milked. Costs of production are not uniform throughout the country. In the South, for example, costs for housing and certain feeds are lower; therefore, a profitable level of production may be below 4000 pounds.

Cows that are low producers should be identified early and culled, because a poor dairy cow is not a dual-purpose cow and is a poor competitor for one. It is apparent that if 160 pounds of butterfat is just on the verge of profit, with an average annual production of about 180 pounds, many cows being milked are in the unprofitable class. Rapid herd improvement will follow the culling of cows of low productive capacity.

Economy of High Producers

The fact that the amount of milk and butterfat produced is related to economy of production has been demonstrated many

times. The evidence presented by McDowell¹ from the records of 120 cooperative cow testing associations clearly demonstrates the relation between production and profit. The cows are grouped in classes according to the level of their yearly butterfat production. The table on page 270 includes the groups having a fairly large number of cows.



FIG. 97. A Holstein-Friesian cow, Carnation Ormsby Butter King, bred and owned by Carnation Milk Farms, Seattle, Wash. In 365 days she produced 38,607 pounds of milk and 1402 pounds of butterfat. This constitutes the highest record of milk and butterfat production in the United States.

It should be pointed out that although the group with an average butterfat of 109 pounds had an income over and above feed costs, they were a long way from being profitable since feed is but one of the cost items. In a comparison of the groups which produced 109 pounds of butterfat and the group credited with 446 pounds of butterfat annually, it will be observed that as the production was increased fourfold the gain in income was tenfold. The average cow in the low group returned but \$12.48 over feed cost, while those in the high group have an income of \$124.85 after deducting the cost of the feed. As the production

¹John C. McDowell, *Bull.* 1069, U.S.D.A., 1922.

RELATION OF FAT PRODUCTION TO INCOME OVER COST OF FEED
A Summary of Cow Test Association Records¹

<i>Number of Cows</i>	<i>Butterfat Produced, Pounds</i>	<i>Average Butterfat, Pounds</i>	<i>Selling Price, Cents per Pound</i>	<i>Gain</i>
43	26 to 76	58	41	\$13.88*
600	76 to 125	109	44	12.48
2305	126 to 175	154	44	27.90
4310	176 to 225	202	44	42.45
4748	226 to 275	251	44	57.82
3385	276 to 325	298	44	73.34
1635	326 to 375	347	44	89.67
652	376 to 425	396	44	105.07
214	426 to 475	446	45	124.85
79	476 to 525	493	43	135.30
27	526 to 575	543	40	134.80

* Loss.

becomes greater the overhead expense becomes relatively less, leaving a greater proportion for profit. High production obtained by economical methods is essential for profitable dairying.

Since roughage is used mainly for maintenance the cost for that item as well as labor, housing, bull service, interest, taxes, depreciation, veterinary would be much the same for the high- and low-producing cows. The main difference in expense would be the great concentrate consumption of the more productive cows.

Individual Variation of Production

As milk and butterfat production have been developed in dairy cows there has been greater variation in the amount produced. Cows at the level of production sufficient to give a calf a good start and no more do not vary much. Within the groups given in the previous table there is a large variation of production, and it is quite obvious that there is more in the groups at the upper levels than in the lower brackets.

A striking example of this variation is the case of the two cows sired by the same bull that were kept under comparable conditions and given equal opportunity. For an average of two years the high producer yielded 7192 pounds of milk and 388 pounds of fat yearly, while the low-producing half-sister produced but 2695 pounds of milk and 124 pounds of fat.

¹ McDowell, U.S.D.A. *Bull.* 1069 (1922).

Cause for Wide Variation in Production

It has been found that the low-producing cows are no less efficient in utilization of feed than high producers. In fact, it has also been found that the ability to digest feeds is not related to breed, age, or milk-producing capacity. Likewise, the requirements for maintenance are not significantly different.



FIG. 98. A Jersey cow, Brampton Basilua, owned by B. H. Bull and Son, Brampton, Ontario, Canada. An outstanding individual with a noteworthy life-time production record. In six lactations she has produced 100,341 pounds of milk and 6366 pounds of butterfat.

The principal difference between high and low producers is the capacity for feed consumption and ability to convert it to milk. The reason for this is apparent; if there is no difference in the ability to use the feed or maintenance, there must be a difference in the amount used. With greater feed consumption there is a larger proportion available for making milk. This explains why capacity for feed consumption, or the size of the barrel, is given considerable emphasis in dairy cattle selection. Such a

cow can consume more feed, and a large amount may be used for milk production.

Eckles¹ compared two somewhat similar cows kept under comparable conditions. One cow produced about three times as much milk as the other and as a consequence consumed more feed. The higher producing cow used but 35 per cent of her feed consumption for maintenance while the lower producer required 56 per cent of the feed she consumed for that purpose.

A high-producing cow has a relatively large amount of the milk-secreting hormone. This endocrine secretion stimulates milk secretion. Also in high-producing cows there is a large amount of secretory tissue. Since the materials for the milk come from the food intake directly or indirectly, the lactating cow has a good appetite and consumes great quantities of feed. It should be pointed out that the urge for secretion may be so great that body accumulations of nutrient material are somewhat depleted by lactation. As it is impossible to estimate the extent of milk-producing hormone secretion we cannot be certain about the milk production. Good milk cows will put on flesh in the dry period and lose it when milking. It does not pay to heavily feed cows that do not milk heavily as poor dairy cows are not efficient beef makers. However, it is usually economical to feed good cows well. As milk production is inherited, we select for breeding those cows which come from highly productive parents.

Dairy Herd Records

One of the essentials of successful management of the dairy herd is the keeping of adequate records. This involves the identification of the individuals in the herd so that individual records may be kept. Without records it is impossible to tell which are the productive and profitable cows in the herd. A record of production will enable the dairyman to make proper selections for the breeding herd, eliminate unprofitable cows, and intelligently feed his cows.

The most important record on the individual cow is the amount of milk produced. The range of production within a

¹ Clarence H. Eckles, *Dairy Cattle and Milk Production*. The Macmillan Company, New York, 1939.

breed is five times as great in the volume of milk as the butterfat test. The amount of milk is therefore more important than the test for butterfat in determining production. In practice, one or two days' weights of the milk are made once a month or in some cases every two months. Such weights form the basis for fairly accurate estimates of yearly production. Daily weights of the milk are of course more accurate, and more promptly inform the dairyman of changes in production. Butterfat tests are commonly made monthly, and the estimate of monthly production of butterfat from such tests will be accurate within 5 per cent.

Cow Testing Associations

The purpose of the cow testing association is to provide means for testing the production of cows in the organization. The associations are cooperative, usually consisting of about 26 dairy farmers, and a man is employed to do the testing. The tester visits each herd each month, and secures the weight of the milk yielded by each cow. In some associations bi-monthly testing is used and the membership may be twice as large as where monthly testing is used. A composite sample is made of the milk of each cow, and the butterfat is determined by the Babcock test. From this data the monthly production for each cow is determined and reported to the owner.

Since the information obtained is useful in planning a breeding program, the cow testing organizations are often titled "dairy herd improvement associations." Their value extends beyond breeding and improvement, since the cow tester aids the farmer in feeding and management problems. That the associations are effective in increasing production is indicated by the fact that the average yearly production of cows in the associations is 322 pounds of fat and 8015 pounds of milk, which is nearly twice that of the average for the country. Through the culling of low producers and the improvement of production methods production has been nearly doubled.

Official Testing

Records such as have been given are determined by official testing. The breed associations have set up certain standards

which are the basis for selective registration of individuals meeting a certain minimum of production. Sires are also admitted on the basis of the production of their daughters. The breed associations have what is defined as an advanced register. The dual-purpose breeds also have an advanced register. The associations differ in their requirements, which are corrected for age, and also in the designations given to the classes. Various herd



FIG. 99. A Guernsey cow, Superb's Faithful. World record Guernsey cow in Class A.A. She produced 19,678.7 pounds of milk and 1077.4 pounds of butterfat. (Foremost Guernsey Association, Hopewell Junction, N. Y.)

test plans have also been developed by the associations in which all the milking animals in the herd are entered.

The semiofficial method is used in making these tests. A representative of the agricultural college in the state supervises the testing within that state and a test supervisor conducts the test monthly or bimonthly on the farm. The owner weighs and makes records of the milk yielded at each milking, and the production for the period 305 or 365 days is based on that weight and the butterfat test determined for the short period. Therefore it is semiofficial as contrasted with such short-time tests as

the seven-day test, in which the supervisor weighs each milking for the entire period.

Records of Champion Producers

Some very phenomenal records have been made by dairy cows. Formerly short-time records such as 7-day and 30-day periods were used for measuring production, but they have been found to be less reliable than records for longer periods. Yearly



FIG. 100. A Brown Swiss cow, Jane of Vernon, owned by Judd's Bridge Farm, New Milford, Conn. In three and one-half lactations this cow produced 76,254 pounds of milk and 3574 pounds of butterfat. She is regarded as having one of the most perfect mammary systems to be found on any dairy cow.

records are commonly given as such may cover a common lactation period. More emphasis is being put on lifetime records since a yearly record is only one expression of production.

Perhaps too much emphasis has been placed upon the top yearly records since they are often made under forced conditions. Economy of production and sometimes the future usefulness of the individual are secondary in making a high record. However, such records at least point out the potentiality of production.

A list of the record cows in milk and fat production of the various breeds in the United States is given below.

	<i>Yearly Production, Pounds,</i>	
	<i>Milk</i>	<i>Fat</i>
Holstein-Friesians		
Carnation Ormsby Butter King		1,402.0
Carnation Ormsby Madcap Fayne	41,944.0	
Jersey		
Brampton Basilua		1,312.8
Abigail of Hillside	23,677.0	
Guernsey		
Cathedral Rosalie		1,213.1
Murne Cowan	24,008.0	
Ayrshire		
Ardgowan Valda	31,156.0	1,356.0
Brown Swiss		
Illini Nellie	29,589.5	1,200.4
Milking Shorthorn		
Ruth B.	21,641.0	956.7
Red Polled		
Jean Duluth Beauty	20,280.6	891.6

There are several phenomenal examples of long-distance production by dairy cows by individuals of the different breeds. Some of the outstanding long-time records are listed below:

<i>Breed</i>	<i>Name</i>	<i>Length of Record</i>	<i>Age</i>	<i>Production of Milk</i>	<i>Butterfat</i>
Holstein-Friesian	Ionia Aaggie	Lifetime	13 yr.; 5 mo.	230,723	7,350
Holstein-Friesian	Sadie Vale	Lifetime	18 years	228,880	8,510
Holstein-Friesian	La Vertex	Lifetime	Lifetime	213,426	7,374
	Quantity				
	Highfield				
	Colantha				
	Mooie				
Guernsey	Palotterie of	Lifetime	Lifetime	149,401	8,159
	High Rock				
Guernsey	Valors	Seven	16 years	91,888	4,810
	Charity	Lactations			
Ayrshire	Barclay's	Lifetime	22 years	200,131	6,905
	Betty				
Ayrshire	Boggie of	Lifetime	15 years	176,752	6,027
	Eastside				
Jersey	Radiant	Lifetime	17 years	154,327	7,706
	Romance				
	Storrs				
Jersey	Sophie's	Lifetime	Nine-Twice	143,348	7,030
	Emily		Yearly Tests		
Jersey	Sophie 19th	Lifetime	Lifetime	132,206	7,545
	of Hood Farm				
Brown Swiss	Illini	Lifetime	6 lactations	145,773	
	Nellie				
Milking Shorthorn	Trixie 3d	Lifetime	Lifetime	126,270	5,923

Most cows remain in the dairy herd a comparatively short period of time; as a consequence, their record of production is but a small proportion of their potential production. Disease, nonbreeding, and other conditions result in short periods of productivity for individual cows in the average herd. The above records have been made by heavy producers over a comparatively long period.



FIG. 101. An Ayrshire cow, Barclay's Betty, owned by Strathglass Farm, Port Chester, N. Y. A 21-year-old cow with a life-time record of 200,131 pounds of milk and 6905 pounds of butterfat. She is the dam of 16 calves that have produced 1200 descendants.

Milk Cows—Economical Producers of Human Food

The dairy cow is a very efficient converter of farm feeds into human food. A comparatively large proportion of the nutrient material consumed by efficient cows is converted into milk nutrients. The milk cow produces more human food from the feed she consumes than any other farm animal. The cow is followed by the hen as a converter of protein into human food,

while the hog ranks second to the cow in efficiency as a converter of energy.

Comparisons between various farm animals, and their efficiency of conversion of nutrients in the feeds consumed into human food, does not give the entire story in economy of production. In the first place, the feeds consumed by different kinds of livestock are not comparable, and second, the feed is just one item in the production costs.

In spite of the fact that there is a difference in recovery of food value from feed and making it available for human use, there is a place for all of our domestic animals. All of the edible animal products are used in the human diet. For example, milk and meat are not directly competitive for a part of the diet. Also, each kind of livestock fills a place in a balanced farming program, and each is suited to a particular situation. Dairy cattle might be a logical choice under certain circumstances, that is, with an ample feed supply and a suitable market, while beef cattle would be more adaptable to range feeding conditions and greater distance from the markets.

Chapter 17

CONSUMPTION OF MILK AND DAIRY PRODUCTS

The several outlets for milk available to the dairy farmer have been previously discussed. About four-fifths of the farm-produced milk is sold, while the remainder is consumed on the farm where it is produced. That which is sold may reach the ultimate consumer in one of many forms, depending upon the demand for the different dairy products which is an expression of the consumer's preference. The total amount of milk and milk products consumed in the various products appears to shift from year to year.

Milk as a Food

Milk is our best single food. It is the natural food of young mammals and therefore quite well suited to their needs. Milk is not a nutritionally complete food; it needs supplementation to form an adequate and ample diet. However, milk is particularly good to supplement the cereal grains which normally provide the bulk of the energy value in our diet. Milk, because of the quantity and quality of its protein and its content of essential vitamins and minerals, provides a valuable asset in most diets, especially for the young. Milk is regarded by many as an absolute essential in the human diet. It is commonly referred to as the "most nearly perfect food."

Milk may be fortified in certain ways to make it a more complete food. One rather widely used addition is that of Vitamin D. This is the antirachitic vitamin which is involved in normal bone growth. Rickets, a bone disease, may be due to an inadequate supply of Vitamin D. Milk fortified with this vitamin will prevent rickets. Three methods of fortification are in use: (1) direct exposure of the milk to ultraviolet light; (2) feeding cows irradiated yeast or other material high in Vitamin D; (3) adding Vitamin D concentrates to the milk.

In volume as well as quality, milk and milk products rank

high. It has been estimated that about one-quarter of the food consumed by the average person is milk and its products.

Utilization of Total Milk Produced

The uses of milk yearly for the decade 1930-1939 are shown in Figure 102. It will be noted that about 42 per cent of the milk produced is consumed as fluid milk and cream on farms and in

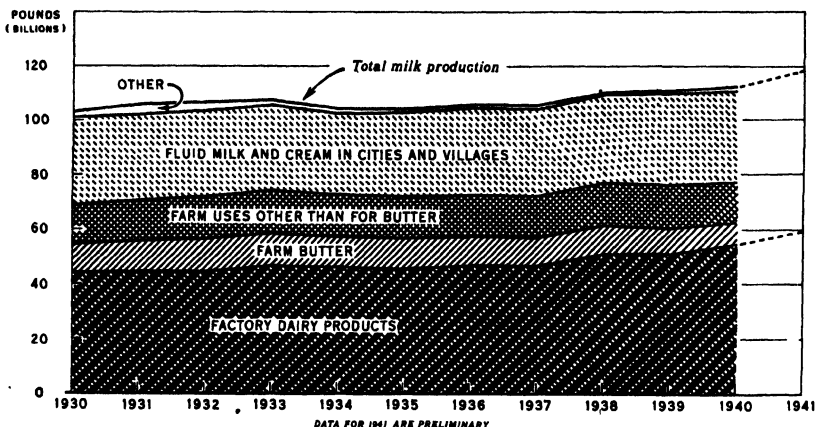


FIG. 102. Utilization of total milk produced in the United States. About 42 per cent of the milk produced is consumed as fluid milk and cream. About one-half of the milk produced is used for manufactured dairy products. (U.S.D.A., Bur. of Agri. Economics.)

cities and villages. The milk sold in cities and villages by distributors is largely standardized by the mixing of the milk taken in from the different farms. Milk that enters the market milk trade is a fairly uniform product which is quite generally prepared by pasteurization. More than half of the milk produced is used for manufactured dairy products, including butter made on the farms.

Per Capita Consumption of Dairy Products¹

The milk equivalent of all of the dairy products used per person for a recent ten-year period is 95.19 gallons per year, or

¹ In the conversion of milk into the common milk products:

One pound of butter is the equivalent of 21 pounds of milk.

One pound of cheese is the equivalent of 10 pounds of milk.

One pound of evaporated or condensed milk is the equivalent of 2.2 pounds of milk.

One pound of ice cream is the equivalent of 15.0 pounds of milk.

about 819 pounds. The consumption of milk and the milk equivalent of cream consumed per capita by that part of the population not on rural farms amounted to 38.3 gallons.

The balance of the consumption was in the following dairy products and in the amount given. Butter, 17.49 pounds; cheese, 5.04 pounds; evaporated and condensed milk, case goods, unskimmed, 14.11 pounds; commercial ice cream, 1.76 gallons.

Milk consumption is the heaviest on a per person basis in the north Atlantic region, followed by the north central, the western, the south Atlantic, and the south central in the order named.

Changes in Consumption of Dairy Products¹

Milk and cream consumption increased during the 1920's and reached a high point in 1929. A temporary decline followed in the middle 1930's, probably mostly among city populations. A rise in consumption took place in the late 1930's, and in 1939 consumption was almost up to the 1929 level. The increased consumption during the last decade has been due to greater per capita consumption of city populations.

Butter has shown no decided trend in per capita consumption, except during the first World War when consumption declined. Butter production was not stimulated during the war, and as a consequence consumption declined. High prices later stimulated production, and consumption rose accordingly.

Manufactured dairy products have steadily increased in consumption since 1909. Development of processed cheese and improvement in its packaging and distribution have stimulated consumption. Similar progress has been made with a variety of other dairy products. Consumption of evaporated and canned milk has increased more than threefold since 1909. This increase has been due to the improvement of processing and the relative prices of the condensed products and fresh milk and cream.

Consumption of ice cream per capita has increased sixfold since 1909. During the depression of the early 1930's ice cream consumption was quite low, but by 1937 the rate was back to its former level.

¹ *Consumption of Agricultural Products*, B.A.E., U.S.D.A., March 1941.

The change in consumption of dairy products in the last decade is shown in Figure 103.

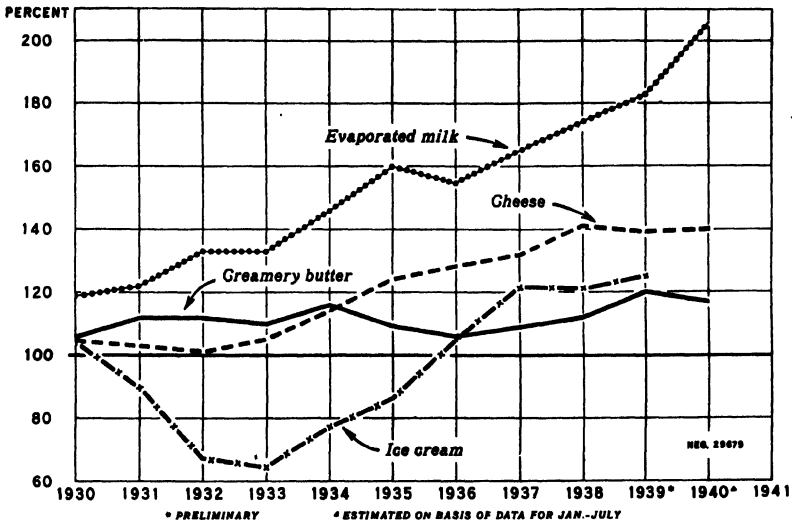


FIG. 103. Consumption of dairy products in the United States. There has been a marked increase in the consumption of evaporated milk. Consumption of ice cream has also increased since the depression. Cheese consumption has increased slightly, while butter consumption has not changed materially. (U.S.D.A.)

Grades of Milk

Grades of market milk are determined by local requirements, and these depend in part upon the demands of the trade. Milk grades are based upon conditions under which the milk is produced as well as indications of quality such as bacterial count, sediment or cleanliness, and other factors. Roughly, milk is divided into two classes — raw and pasteurized. The former is not prepared in any way except that it is cooled. In this class is included "certified milk." Such milk is the highest quality raw milk obtainable as it is produced under very exacting conditions. The term has been registered in the U. S. Patent Office, and milk designated as such must conform with strict regulations for production and distribution.

Two other grades of raw milk in general use are Grade A

Raw and Grade B Raw. The first of these is the highest in quality. Other grade terms for raw milk are not uncommon.

Pasteurized milk is not so generally graded, although in certain localities Certified, Grade A, and Grade B are common.

Butter Grades

There are several market class terms applied to butter offered for sale. For example, we have sweet or ripened cream butter, which indicates whether sweet cream or ripened cream was used in its manufacture. We also have creamery butter which is factory made, and farm or dairy butter made on the farm. Likewise there may be another classification based on the use of salt. That without salt is referred to as sweet or unsalted butter, while usual butter contains about from 2.0 to 3.5 per cent of common salt. Renovated or process butter is that which is melted, refined, and reworked. Butter can be made from the cream separated from whey, and this is designated as whey butter. Low-grade butter is known as packing stock and is used for making renovated butter.

Market grades of creamery butter are based upon the flavor, body, color, salt content, and packaging of the butter. These constitute the major divisions of the butter score card and are weighed in the order named—that is, flavor is the most important item in butter grade. On the market, butter seldom scores more than 93 or 94 points.

The usual grades for creamery butter and the score for such butter are given below.

<i>Grade</i>	<i>Score</i>	<i>Qualifications</i>
Special	93 or above	Clean, sweet, creamy, with no off flavors.
Extras	92	Clean, sweet. Lacking somewhat in rich, creamy flavor.
Firsts	88 to 91½	Has a slightly objectionable flavor.
Seconds	83 to 87½	Possesses off flavors, such as fishy, stale, unclean, rancid, or cheesy.
Thirds	80 to 82	Lowest grade butter, seldom used for human food.

Pasteurization of Milk

Milk is treated with heat or pasteurized in order to destroy pathogenic or disease producing organisms. Milk is pasteurized by two methods. *The holding process* requires the heating of the

milk to 142–145° F. for 30 minutes and then cooling rapidly. *The flash process* is accomplished by heating the milk to 165–180° F. and then cooling. The holding process is more generally used. States and cities specify the requirements for pasteurization.

Pasteurization has only a minor effect upon the constituents of milk and it renders milk safe for consumption, since but 1 or 2 per cent of the organisms which it contains survive the process. Apparently none of the disease-producing organisms are resistant to pasteurizing. The composition is not altered in this treatment, but the cream line may not be so deep in the pasteurized milk, especially if the cooling is not rapid.

Fresh, raw milk, from healthy cows, produced under sanitary conditions and handled in such a way that it is free from contamination, would be preferred to pasteurized milk. But, as it is impossible to maintain such conditions, pasteurizing is a necessary safeguard of health. Most cities permit the sale of either raw or pasteurized milk. It has been estimated that at least 90 per cent of the market milk is sold as pasteurized.

Prices Farmers Receive for Milk¹

Milk sold in wholesale lots by farmers through cooperatives and to whole milk distributors and milk products manufacturing plants brought about \$1.70 per 100 pounds to the farmer producers. This is based upon the average prices by months for the decade 1930–1939. In that period the price ranged from a low of \$1.27 in 1932 to a high of \$2.21 in 1930.

There is a seasonal variation in the milk prices, with a low in the summer and a high in winter, as would be expected.

As production is higher in the summer months, milk prices are lower at that period. At the same time costs are lower in the summer, because of lower feed cost, less housing, and less labor.

Milk sold to condenseries brings less to the producer than the average milk sold. In a comparable period 100 pounds of milk, testing 3.5 per cent butterfat, brought about \$1.28, or about 42 cents less than average milk. Some seasonal variation in the price of such milk occurs and it is the same general pattern as

¹ *Agricultural Statistics, 1940, U.S.D.A.*

AVERAGE MONTHLY PRICE OF MILK
PER HUNDRED POUNDS

<i>Month</i>	<i>Price</i>
January	\$1.82
February	1.77
March	1.70
April	1.61
May	1.54
June	1.51
July	1.58
August	1.67
September	1.76
October	1.81
November	1.96
December	1.84

Average of average \$1.70

average milk. The milk used for this purpose is much more seasonal in production than that disposed of through other channels.

The milk dealers' average buying price per 100 pounds for standard grade milk testing 3.5 per cent butterfat, which is used for city distribution as milk and cream, is also available. Such milk brought the producer \$2.10 per 100 pounds on the average in the ten-year period f.o.b. the local shipping point or country plant. Market milk must meet certain standards of quality in addition to butterfat content. The conditions on the farms where it is produced and in the processing plants must meet certain standards. City and state regulations set these standards, and minimums are prescribed for such features as bacterial count and sediment test. Such milk is therefore more costly to produce than milk produced under conditions which do not comply with equal sanitary regulations. Milk so classified shows very little seasonal variation in price.

It is evident that, as compared with the usual outlets for milk, that which is standard grade and used for city distribution is sold at a premium, while that which is sold to condenseries will bring lower prices.

Cost of Distribution of Milk

Only about one-half of the cost of milk to the consumer is received by the original producer. Distribution costs vary

from city to city because of the variation in local costs. A survey of milk company records by the Wisconsin State Department of Agriculture in 1938 indicated a distribution cost as follows:¹

<i>Per Cent of Total Cost</i>	
Product cost	52.31
Delivery labor	19.24
Delivery expense	8.21
Plant expense	6.33
Plant labor	4.94
Administrative labor	2.78
Profit	2.33
Administrative expense	2.18
Office labor	1.68

The cost of delivery accounted for over 27 per cent of the cost of the milk to the consumer and is more than one-half the cost of the milk to the distributor. It is quite obvious that milk can be sold to the consumer several cents cheaper per quart on a cash and carry basis than when delivered.

Milk Prices Retail

Prices for milk vary greatly from city to city. For example, for the year 1939 the dealer retail price per quart delivered to the family trade in Detroit, Michigan, was 9.9 cents per quart, while in Jacksonville, Florida, it was 16.0 cents per quart. These two cities presented the extremes in price for 25 cities in 1939. The milk prices appear to be higher in the largest cities and those in the South.

Marked year to year differences also appear. In Chicago, for example, the average yearly retail price per quart delivered to the family trade has ranged from a 9.8 to 14.0 cents per quart in a ten-year period.

Milk as Compared with Other Foods in Cost

The economy of the dairy cow as a converter of farm feeds into human food has been previously pointed out. Since the value of a food cannot be expressed in a single term, it is not possible to compare foods like milk and meat, for example. These two foods are not comparable in composition, and we

¹*Milk Facts*, Milk Industry Foundation, 1940.

have no way of converting for comparison the different nutrient materials to a common basis. Since energy is the greatest single nutrient essential provided by foods, this may be used for a basis of comparison. Yet this only gives an energy comparison, and does not give credit for such food essentials as protein, minerals, and vitamins. Milk, because of its composition, furnishes most of the essential constituents in adequate amounts. However, on the basis of cost, lard may be a more economical source of energy, and lean meat a more economical source of protein. Yet milk is an excellent and economical food for children and adults.

Oleomargarine and Butter

As the price of butter goes up the consumption of oleomargarine increases. In fact, the consumption of the butter substitutes moves about in the same fashion as the margin between the price of butter and oleomargarine. In other words, as the price margin widens, the consumption of oleomargarine increases.

In a recent ten-year period the retail price of butter was 37.6 cents per pound while oleomargarine was 18.8 cents per pound, a margin of 18.8 cents. The per capita consumption of oleomargarine ranged from 1.6 to 3.1 pounds with an average of 2.5 pounds during the same period.

Butter consumption is higher among the people in the higher income brackets. Oleomargarine is substituted for butter as the family incomes decrease, because of its lower price.

Chapter 18

DAIRY CATTLE FEEDING AND MANAGEMENT

The largest problem confronting the dairyman is that of feeding the herd of cows that are milking. Economical rations that are ample in required nutrients are essential for success. Raising dairy calves, feeding the herd sire, and feeding the dry cow are problems which may be troublesome to the dairyman, but his big job is to feed intelligently the cows in milk. Attention to feeding and management alone does not ensure success in milk production. The efficiency of the cow is an all-important item in profit from the enterprise. Not only is it unprofitable to feed a cow lacking in dairy breeding the way dairy cows are fed, but among those selected and bred for milk production some are inefficient and unprofitable.

The feeding of dairy cattle has been studied extensively. Several excellent textbooks on the subject are listed in the Appendix. Further, in most states where dairying is an important enterprise, the subject of dairy cattle feeding is covered in at least one publication from the state agricultural college and experiment station. There are also several publications available on this subject from the U. S. Department of Agriculture. It is not the purpose of this text to cover in detail dairy cattle feeding, rather a survey of the nutritive requirements and feeding and management practices are given.

Dairy cattle are kept under a wide range of conditions. However, it is impossible to maintain a dairy herd under circumstances such as prevail on the range. Specialized milk production requires feeding and handling that are not possible with a range herd. Pasture is the natural feed for the dairy cow and under most conditions it retains a place in the ration. As production has been stepped up in the milk cow, the nutrient needs have been increased to the extent that pasture alone will not suffice the heavy producer. In the evolution of dairying

we have more closely confined our milk cows, and the ration of necessity has come to include other feeds.

Even though dairy cows are not suitable for extensive ranging, they are kept under quite divergent circumstances. The extreme range of production affects actual requirements and as a consequence the feeding. Cow herds kept at some distance from the centers of population for the greatest part have ample pasture and relatively low-priced farm-grown feeds. On the other hand, a dairy enterprise near a dense human population has high-priced land which makes for expensive pasture and farm feed. Such farms purchase more feed than the farms farther removed, but they have the advantage of nearness to the market for the sale of their products.

Nutritional Requirements of Dairy Cows

In the dairy cow we recognize such productive needs as maintenance, growth, reproduction, and milk secretion, all of which demand certain nutrient materials. In practice it is difficult and impractical to separate the nutritional needs, with the exception of milk production. It has proved feasible and economical to alter the feed in quantity according to the quantity and quality of the milk produced by the cow. Feeding standards included under maintenance provide sufficient surplus to permit normal reproduction and some growth.

There are numerous feeding standards for the dairy cow. They are much the same in general but vary slightly in suggested amounts of nutrients. The requirements are given in terms of digestible protein and total digestible nutrients or net energy or some adaptation of these values of feeds.

A 1000-pound dairy cow should have for maintenance alone the amounts of nutrients daily shown in table on p. 290, according to the Morrison Feeding Standard. The suggested amount of nutrients for milk production is also given.

The maintenance requirement is in proportion to the 0.73 power of the live weight, as the needs are not directly proportional to the weight. The nutrients for milk production are varied in accordance with the butterfat content.

The requirements for maintenance are not so different from those suggested for a 1000-pound beef cow that is pregnant and

Digestible Protein		Total Digestible Nutrients		Net Energy	
Minimum Allowance, Pounds	Recommended for Good Cows under Usual Conditions, Pounds	Minimum Allowance, Pounds	Recommended for Good Cows under Usual Conditions, Pounds	Minimum Allowance, Pounds	Recommended for Good Cows under Usual Conditions, Pounds
For maintenance 0.6	0.65	7.0	7.93	5.95	6.74
For Milk Production—Per Pound of Milk					
3.5 per cent milk 0.038	0.046	0.284	0.300	0.264	0.279
4.0 per cent milk 0.041	0.049	0.307	0.324	0.286	0.301

being wintered, except that the total digestive nutrients are less and the nutritive ratio narrower. The basal needs for the two are quite comparable, and a satisfactory ration for one would be ample for the other.

Individual feeding is generally the case with dairy cows when in milk, which is quite a contrast with beef cows, which are group fed. Rations for dairy cows are on the basis of the individual cow, while in beef cattle an average ration for an entire lot is commonly used. It is economical to have dairy cows consume all of the good-quality roughage they will take. If at least one-third of it is leguminous in winter feeding, this intake will meet the maintenance needs, and if the roughage is of good quality, it will be nutritionally complete. During the summer, good pasture is a valuable and economical addition. Concentrates are fed then to provide for the milk produced.

Balanced Rations

Various meanings have been attached to the term "balanced ration." A ration may be balanced according to a feeding standard when the nutrients in the feed allowance or intake balance the daily requirement for the individual. Most feeding standards set the requirement for dry matter, digestible protein, and total digestible nutrients or net energy which does not include *all* of the dietary essentials. For the maintenance of a

1000-pound cow the minimum allowance advised would be met if we fed 31.6 pounds per day of wild oats as green roughage. In other words, the intake of digestible protein and total digestible nutrients would meet the prescribed minimum allowance. It is quite evident that such a ration is impractical and would not be satisfactory. It may be lacking in some of the essentials. An adequate ration would contain all the factors needed and some use this term synonymously with a balanced ration. It is evident that such rations to be adequate must contain: (1) ample protein of proper quality, (2) sufficient total digestible nutrients or net energy, (3) ample amounts of calcium, phosphorus, sodium, chlorine, iron, and other essential minerals, (4) abundant quantities of vitamins A and D and other essential vitamins, (5) enough of the essential fatty acids and other dietary indispensables.

In practice the dairyman uses the balanced ration. By giving attention to the general requirements of a satisfactory ration, an adequate combination of feed is made. The feeding standard is at best only an approximate guide. The composition of feed is based upon averages, as are the animal requirements, although the latter have a considerable margin of safety. It is, therefore, evident that values given for feeds or the requisites given for animals are not absolute.

General Requirements of Satisfactory Rations

Certain general precautions are taken in combining feeds into rations suitable for dairy cows in milk. These general requirements are listed below.

VARIETY

In formulating rations it is suggested that at least two roughages and three concentrates be included for a good cow, and still more variety be given a heavy producer.

PALATABILITY

Feeds including both concentrates and roughage should be palatable and therefore readily consumed by the cow.

SUCCULENCE

Cows fed succulent feeds almost always produce more milk in winter than when such feeds are not included in the ration. In the absence of succulent feed like silage in winter, the best quality of roughage and constant access to a water supply are suggested to maintain milk flow.

BULKINESS OF THE CONCENTRATED MIXTURE

It is thought to be of value to have some bulky feeds in the concentrate mixture, especially for cows heavily fed on concentrated feeds. Light feeds, such as ground oats, wheat bran, and beet pulp, are desirable for this purpose. Their use provides a more porous mixture.

LAXATIVE FEEDS

Slightly laxative feeds are preferred for the ration since it has been found that rations of that effect are more efficient.

EFFECT UPON THE MILK

Some feeds affect the flavor of the milk. Such feed should be avoided in compounding a ration.

EFFECT UPON THE COW

Feeds that have a harmful effect upon the cow, because of the physical nature or chemical composition, are also to be avoided. Some feeds cause digestive disturbances, while others, such as ergot, contain toxic materials.

COST OF THE RATION

Lastly, the matter of cost is given as one of the general requirements. Perhaps it should be the major consideration, since profit from the enterprise depends upon costs involved and the income from the product. Feeds make up about one-half the cost of milk production. It is, therefore, evident that the cost of the nutrients in the feeds is an important consideration in feed selection.

General Rules for Feeding

Certain general rules have long been in use for approximating rations for milking cows. At best they are merely rough estimates and lack accuracy as compared with rations computed according to a feeding standard. These "thumb rules" are fairly accurate and easily applied; consequently they are stated.

1. Allow all the roughage a cow will eat.
2. Feed one pound of concentrates per day for each $2\frac{1}{2}$ to 4 pounds of milk, depending upon the richness of the milk and the quality of the roughage fed — or
3. Feed one pound of concentrates per day for each pound of butterfat the cow produces a week.

Modifications have been made upon the above rules mainly to adjust the concentrate intake to the quality (butterfat content) of the milk and the quality of the roughage consumed.

In following these general rules there is a distinct tendency to underfeed the high producer and overfeed the low producer.

Winter Feeding

The dairy cow has less natural protection than the beef cow and in the winter time barn feeding is a necessity in many sections. Dry, well-ventilated, and well-lighted barns are essential for comfortably housing the dairy herd. The common method of handling in the winter is to feed in the stall or stanchion. There is what is known as the loose-stabling method, in which the cows are fed roughage in a large stable or shed. The cows are confined in the barn for feeding of concentrates and milking. Even stabling in an open shed that is dry, well-bedded, and not drafty has proved satisfactory.

When leguminous hay is available for roughage the feeding problem is comparatively simple as the usual allowance of 2 pounds per day per every 100 pounds will more than meet the maintenance needs. Further, such roughages work well with combinations of home-grown grains. With nonleguminous hays, a grain mixture higher in protein is indicated and protein concentrates are needed.

Silages are very extensively used in the ration. On most farms it is an economical feed, for in nutritive value three

pounds replaces about one pound of roughage. Silages are made from many different plants, and corn silage is a variable feed depending upon the kind of corn from which it is made. Silage should be compared with other roughages on the basis of the cost of its nutrient value. It has many advantages in the dairy ration, but it is not indispensable and its use should depend upon relative cost.

Roughages are commonly cheaper sources of nutrients than the grain even though they are less digestible. Concentrates



FIG. 104. Barn feeding of dairy cows.

have at least 25 pounds more total digestible nutrients than roughages in 100 pounds of feed. This is because the nutritive energy in concentrates ranges in digestibility from 75 to 100 per cent, while with roughages the digestibility ranges from 30 to 75 per cent. It is evident that a ration of roughage alone would be insufficient for a highly productive cow. On the other hand, cattle do not thrive on grain alone. Since roughage is economical and essential, a combination of roughage and concentrates is used for the milk cow.

The best procedure appears to be to select the feeds for the

cow so that the necessary minerals and vitamins are supplied. Common salt is the exception, and under some conditions phosphorus, calcium, iodine, and perhaps some other minerals are insufficient in the natural feeds.

Summer Feeding

Summer feeding differs from the winter feeding in that pasture is available and less housing is needed. Pasture should



FIG. 105. Dairy cows on sweet clover pasture.

be a part of the dairy cow's feeding program as it appears to be necessary for fertility and economical production. Good pasture provides an abundance of vitamin A or carotene, the precursor of vitamin A, and other dietary essentials not too plentiful in winter rations. Also, cows that are pasture fed are exposed to sunlight, which gives vitamin D. Pasture supplies many of the essentials lacking in barn feeding, and as a consequence prevents diseases or inefficient response to feed caused

by deficiencies. Also on pasture, reserves are built up which are carried over into the winter feeding period. The pickup in production which attends the turning of the cows on pasture is proof of its high value.

The great difficulty with pasture is that in general it is poorly managed and that good-quality pasture grass is not available throughout the season. High-producing cows cannot maintain production on pasture alone, and many pastures are insufficient for average production. Young pasture grass is high in protein and low in fiber, and will supply an ample amount of nutrients to sustain a cow yielding about 40 pounds of milk daily. Cows may consume up to 150 pounds of pasturage per day. One to three acres is required to provide ample pasture for one cow, depending upon growing conditions. In fact, pasture under some conditions may be luxuriant enough to pasture two cows per acre.

Cultivated land can be used for pasture and under favorable conditions the production of nutrients will be comparable to that of other crops. Permanent pasture, too, may yield a good return if pastured by dairy cows. Such pastures are often abused in that they are grazed too early and too heavily. Pasture improvement in the control of weeds, seeding suitable grasses, and fertilizing will be reflected in sustained production of nutrients.

In management there is a general tendency not to properly supplement pasture with other feeds. Silage crops, concentrates, hay, silage, and supplementary pasture may augment declining regular pastures. If milk prices are low, supplemental feeding with concentrates may not be advisable.

Feed Equivalent in Price to One Pound of Butterfat

Based on a 30-year period, 1910-1940, 1 pound of butterfat has been equivalent in price to 25.9 pounds of feed grains. This is a comparison on average prices received by farmers for both butterfat and feed grain. For the 1913-1940 period, 1 pound of butterfat was equivalent in price to 21.3 pounds of by-product feeds such as linseed meal or cottonseed meal. It is quite obvious that, when butterfat sells for much less than the above equivalents, the sale of butterfat may not be a profitable

outlet for feed. With corn at 56 cents per bushel butterfat would sell for 25.9 cents per pound on the average. Further, if the average ratio prevailed, by-product feeds would sell at \$24.32 per ton.

Calf Raising

Since the productive life of the average cow is less than five years, many of the calves must be raised for replacements. This is one of the major items of expense in dairying and also a feature in which many dairy herds are quite inefficient. It goes without saying that only the better calves should be kept for replacements. It costs as much to raise a poor one as a good one. Therefore, only calves of good individuality and parentage should be retained. Diseases are quite prevalent in young calves, and for best results they should be raised under sanitary conditions and fed only nutritionally complete rations.

Nearly all of the calves raised on the dairy farms are raised by hand. On farms selling cream the skim milk is used for calf feeding; where whole milk is the main product, the use of milk substitutes is prevalent, while whey feeding is common in cheese producing areas. Milk feeding continues until the calf is about six months old, but supplementary feeding begins when the calf is about two weeks old.

When the calf has been changed to dry feeds and is well started on them, the problem of raising it is comparatively easy. Good pasture and good roughage, plus suitable concentrate supplementation, ample in amount, will permit proper growth and development.

Management of the Dairy Herd

Careful planning and management are prerequisites to success in the dairy enterprise. Management includes all of the practices in the producing of milk. Milk production is limited, first by the capacity of the cows to produce, and second by the proper feeding, care, and attention for the herd. Phenomenal records of production have resulted in large measure from improvement in management, which includes feeding, breeding, and care.

The following considerations present managerial problems which confront the dairy farm operator.

THE FEED SUPPLY

A dairy herd is kept on a farm to use a supply of feed. This home supply is supplemented with purchased feeds. Good management in this phase requires planning for an ample amount of feed, including the pasture crop, plus securing economical feeds to complete the rations. On usual farms dairy cows are kept to utilize home-raised feeds, and the size of the herd should depend upon the amount of feed grown on the farm. A cow producing 300 pounds of butterfat per year will require the feed and pasture from nearly four acres.

THE BUILDINGS AND EQUIPMENT

A dairy barn that provides ample protection and is equipped so that it is convenient and sanitary is a requisite. In addition to housing the dairy herd and providing for the production of clean milk, facilities are needed for raising the calves and young stock, and housing the herd bull.

THE LABOR REQUIREMENTS

A dairy herd involves considerable labor — more than is needed for a beef herd or sheep flock. Dairy herds are kept on many farms to utilize to advantage available labor.

THE MARKET OUTLOOK

The demand for milk and milk products has been quite constant and increasing. Expansion and contraction of the production should be anticipated in accordance with the favorableness of the outlook. Market requirements are continually changing, and good management requires a knowledge of consumer demands.

KEEPING RECORDS

The production records of individual cows have been stressed previously. Other records are needed by the operator, so that he may know what parts of the enterprise are profitable. A record of the various items of cost will permit an analysis of the

various phases of production. For example, such a breakdown may show that the raising of the replacements is more costly than need be.

PROPER HANDLING OF THE COWS

Dairy cows require considerable care, and the man labor requirement is relatively high. Cows respond to regularity, comfortable surroundings, and gentle handling. A good herdsman concerns himself with proper watering, exercising, grooming, and bedding of the herd. Comfortable surroundings, free from the annoyance of flies and other parasites, help to sustain milk yields.

PROPER CARE FOR CALVES, YOUNG STOCK, AND THE HERD BULL

Replacements are needed and may be costly if proper attention has not been given to the rearing of young stock.

The herd bull should be well quartered, safely handled, and well fed.

MAINTAIN THE HEALTH

Numerous disease conditions may affect the dairy herd. Strong, healthy, vigorous individuals are most profitable in the herd. Strict sanitary conditions need to be maintained to prevent the admission of infectious diseases.

MILK OF HIGH QUALITY SHOULD BE PRODUCED

Quality milk sells for a higher price than an inferior product. Most consumers will willingly pay a little more for milk that is of good quality and free from objectionable materials. Our market milk is commonly regarded as among the best in the world because of its quality, widespread distribution, and the safeguards such as pasteurization generally used in its preparation.

Chapter 19

DAIRY CATTLE BREEDS AND BREEDING

Dairy Cattle Breeding

Much of the material on the reproductive process in beef cattle in Chapter 12 applies to the breeding of dairy cattle. Therefore, in this chapter the discussion will be limited mainly to the breeds, breeding systems, breeding stock selection, and certain features in which dairy cattle differ from beef cattle in the control of the reproductive process.

THE REPRODUCTIVE PROCESS

Some dairy heifers mature sexually earlier than beef heifers, especially those of the smaller breeds. In actual practice the calving of the dairy cows is due to a more uniform level of feeding during the growth of the individual. Beef cattle use grass mainly, and often in the winter period receive restricted rations which may retard development. Dairy heifers are generally fed quite liberally during the winter.

There is a considerable range in the recommended time of breeding heifers of the different dairy breeds. For well-grown heifers it is not uncommon to breed Jerseys as young as 17 months of age, while slow maturing Brown Swiss heifers are more generally bred at two years of age; the stage of the development affects the time of breeding with heifers, but it varies more with the breed than is the case with beef heifers. Size at maturity is apparently not materially affected by the usual difference in time of first calving, provided good feeding is practiced. As a rule dairymen plan to have their well-grown heifers calve when they are about two years of age. Delay in calving beyond two years may be responsible for a little more milk production in the first lactation, but the cost is increased since this practice involves a longer feeding period before freshening. Dairy bulls may be used for light service when

they are about one year old. From the age of two years until seven or eight years a bull may be used heavily. Since the breeding in most dairy herds is seasonal, one exceptionally active bull is kept for every 50 to 60 cows.

Fall calving is much more widely practiced with dairy cattle than with beef cattle; a dairy calf can be well started on skim milk with grain and roughage during the fall and winter, then turned on pasture at weaning time. There is no particular advantage in feeding skim milk beyond six months of age. Fall freshing of the cows also is in most instances quite advantageous.

REPRODUCTION AND MILK FLOW

It is quite apparent that milk production in a cow will decrease as time of subsequent calving approaches. The usual goal is to have a cow produce a calf every 12 months, which would require conception on the eighty-fourth day after calving with a normal gestation period of 281 days. It has been found that cows bred and conceiving between 75 and 110 days after calving will result in the greatest average daily milk production.

Dry periods have been found to be advantageous, considering the long-time production of the cow. With high-producing dairy cows, a dry or rest period of about six weeks is regarded as ample. When rest periods are included in the management plan, the heavy milking cow can build up her body reserve depleted during lactation. A high-producing cow often yields more nutrient material than she is taking in. Persistent milkers are dried up by gradually discontinuing the milking.

Dairy Cattle Breeds

Our dairy cattle breeds are of European origin, some coming from the continent and some from the British Isles and Channel Islands. The Ayrshire is from Scotland, the Jersey and Guernsey from the Channel Islands bearing the same names. The Holstein-Friesian originated in Holland, and the Brown Swiss is a native of Switzerland. The common beef breeds all came from the British Isles, as have the dual-purpose breeds.

It is the function of the purebred cattle breeder to raise seed stock that can be used in the improvement of the common dairy herds. The task of improving the inferior herds is still

unfinished, and there are many herds of nondescript breeding that could be materially improved by the use of a good purebred bull. For a very productive herd it may be very difficult to find a sire which would increase the production of the daughters over their dams in that herd. Consequently, the problem of choosing a herd bull becomes more difficult as the herd is improved.



FIG. 106. First prize Guernsey display herd, 1937 National Dairy Show. Shown by Boulder Bridge Farm, Excelsior, Minn.

CHOOSING A BREED

As is commonly pointed out, the differences which occur in dairy breeds are not highly related to efficiency of production. Success in dairying is much more dependent upon the management of the enterprise than the breed chosen. Yet real differences occur in size, maturity, butterfat content of the milk, and other features which may be pertinent to the choosing of a breed for a specific situation.

The problem of breed selection is affected by the following considerations:

1. The breeding stock available in the locality, also its cost and the probable demand for surplus animals.
2. The adaptability of the breed to local conditions, such as climate, feed, and grazing conditions.
3. Requirement of the available markets for milk and butter.
4. The capacity and economy of a breed to produce — and this should include vigor and constitution for growth as well as for milk and butterfat production. Growing ability is of importance considering the beef and veal value.
5. The personal preference of the operator.

COMPARISON OF BREEDS IN PRODUCTION

The differences in the production of the dairy breeds can be determined from the records made under the advanced register, or register of merit, and the herd improvement test. These tests have been summarized and are reported in the table that follows.

AVERAGE YEARLY PRODUCTION OF MILK AND BUTTERFAT
OF COWS OF DIFFERENT BREEDS THAT HAD OFFICIAL
YEARLY RECORDS TO JANUARY 1, 1938¹

Breed	Advanced Register or Register of Merit				Herd-improvement Test			
	Records of Cows and Heifers, Number	Milk, Pounds	Butterfat		Records of Cows and Heifers, Number	Milk, Pounds	Butterfat	
			Quantity, Pounds	Test, Per cent			Quantity, Pounds	Test, Per cent
Ayrshire	9,022*	10,446	416	4.0	20,571	8,351	338	4.0
Brown Swiss	939	13,643	548	4.0	984	8,577	352	4.1
Guernsey	49,212	10,095	502	5.0	5,229	8,629	425	4.9
Holstein-								
Friesian	56,007†	16,005	546	3.4	52,369‡	11,101	380	3.4
Jersey	56,789	8,556	459	5.36	27,364	6,797	359	5.3

* Includes 1,952 305-day records.

† Includes 15,354 10-month records.

‡ Up to October 1, 1937.

As would be expected, the average production is higher in the advanced register, or register of merit, tests than in the herd improvement test, since the latter includes all of the cows in a

¹ Data from *Farmers' Bull.* 1443, U.S.D.A.

herd. However, there is a rather close agreement in the butterfat test. For example, the average Jersey cow in the register of merit tested 5.36 per cent butterfat, while the herd improvement test indicates a 5.3 per cent butterfat. Yet there was a difference of 100 pounds in the quantity of butterfat produced.

In making comparisons of breeds from these data it should be



FIG. 107. An outstanding Holstein-Friesian bull, Sir Ormsby Skylark Barbella, owned by Pabst Farm, Oconomowoc, Wis.

pointed out that in some instances the numbers are not very great and the averages are the composite of many herds.

BREEDING SYSTEMS

We have the various systems of breeding, grading up, crossbreeding, inbreeding, line breeding, and outcrossing. To some extent these various systems have been tried out. Experimental evidence is not available as to what might be expected from these different methods other than grading up. The grading-up process is a rather elementary step. It is the steps for further improvement that are not too clearly defined. With fairly

accurate means of evaluating the producing capacity of individuals, records are secured which are helpful in making selections and planning matings. The proper use of inbreeding or the milder form, line breeding, for establishing superior strains with high milk and butterfat production has not been clearly demonstrated.

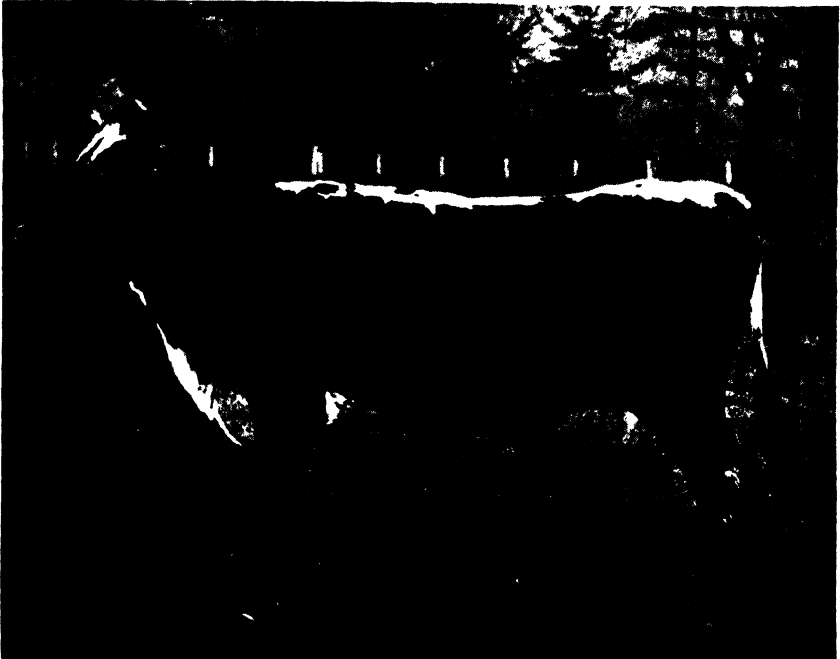


FIG. 108. A milk cow of nondescript breeding. Note the lack of dairy temperament and the small udder.

A consideration of the various breeding systems and their probable use follows.

GRADING UP OF DAIRY CATTLE

The classic experiment at the Iowa Agricultural Experimental Station clearly demonstrated the value of a purebred sire of the various dairy breeds in improving the production of the daughters over that of the dams. Scrub cows mated with good purebred Holstein, Guernsey, and Jersey bulls produced daughters

which yielded 64 per cent more milk and 52 per cent more fat. The granddaughters, which were but 25 per cent scrub breeding, yielded 130 per cent more milk and 109 per cent more fat than their grandams of nondescript breeding. Through successful use of purebred bulls the scrub breeding is decreased by one-half in each generation. Very high grades may resemble purebreds in many respects, but are not accepted for registration on the grounds that the fraction of scrub breeding may carry undesirable characters.

High grades may be nearly up to purebreds in productivity. A survey¹ in New York State indicated that in 553 herds, those which were registered herds had the highest average milk production per cow, while the grade herds were below herds in which both grade and registered stock were kept. Such a difference would be due only in part to breeding as it is quite evident that feeding and management of the purebred herds would be superior to that practiced in grade herds.

In grading up, if different breeds were used we would have crossbreeding as well. Generally grading up is restricted to one breed because of the uniformity secured.

CROSSBREEDING OF DAIRY CATTLE

Crossbreeding in dairy cattle is not uncommon. This practice is said to have had its beginning with the demand for milk of a golden yellow color. This color, it will be recalled, is due to carotene or pro-vitamin A. Another stimulus to crossbreeding was the specifying of a minimum butterfat content of market milk above that typical for some breeds. Since the results of crossing are uncertain and the market demands transitory, it appears unsound to attempt to produce milk of color and test to meet a market demand. For example, in the crossing of Jerseys and Holsteins the crossbred cows would tend to be intermediate in butterfat content of the milk, milk color, and volume produced. However, there is no assurance that the inheritance will be blended in a particular case. Evidence rather indicates that the crosses approach the high-yielding breed in milk production and the low-testing breed in butterfat content.

¹ Farm Economics — New York State College of Agriculture, Cornell University No. 125, May 1941.

The use of crossbreds for breeding is attended with segregation from the intermediate. Also the number of heifers that must be kept in the herds for the maintenance of herd numbers is usually more than one-half of those produced. Continued crossbreeding and vealing the calves is therefore impractical, except for a limited number in the herd.

Based upon investigations and practical experience there seems to be no place for crossbreeding of dairy cattle for the present, other than crosses with beef breeds as discussed in Chapter 12.

INBREEDING AND LINE BREEDING

These two systems refer to the mating of related individuals. When the mating is between individuals rather distantly related it is termed "line breeding," while the mating of closely related animals is referred to as "inbreeding." Through line breeding, relationship to some desired individual or group is kept high by mating descendants from that source that are not highly related to one another. The mating of double first cousins would be commonly called line breeding. The confusion between the two terms "line breeding" and "inbreeding" is illustrated by a comparison of the case just given with another in which half-brother and sister are mated. The latter is commonly referred to as "inbreeding," yet the intensity of inbreeding is no higher than in the mating of double first cousins. Line breeding is actually a mild form of inbreeding.

Line breeding with judicious selection has been the means of establishing some prominent families of dairy cattle. It can be practiced without loss of vigor and vitality if attended with proper selection, and by its means uniformity can be attained. Dairymen have generally accepted line breeding as a useful tool in breed improvement, but they have shied away from more intense inbreeding.

Inbreeding has been shunned by dairy cattlemen because it may be attended with loss of vigor, size, and productivity. It is quite apparent that inbreeding will uncover characters that are recessive. Therefore, it may be a useful thing in determining the presence or absence of such characters which may be objectionable. Since the inbred individuals are more homozygous,

a herd in which inbreeding is practiced would become more uniform if those with undesirable characters were culled.

Breeding Stock Selection

The ideal form or physical appearance of the dairy cow and the dairy bull have been discussed in Chapter 14. It was also developed in the previous discussion that selection may be on



FIG. 109. Langwater Peter. See the extended pedigree with notes Fig. 110. Owned by Charlescote Farm, Sherborn, Mass. (Richard Saltonstall, owner.)

the basis of type or form, production, or pedigree. In dairy cattle, methods of measuring merit have been devised to help form a basis for breeding stock selection. In livestock used mainly for slaughter, there is some difference in the form ideals of the finished slaughter animal and the individuals for the breeding herd. Such a situation does not exist in dairy cattle, as the breeding and market ideals are one and the same. However, some other considerations that relate to dairy breeding stock selection are discussed in the paragraphs which follow.

NUMBERS NEEDED FOR REPLACEMENTS

As compared with beef cattle, a larger proportion of the females must be kept in order to maintain herd numbers. It is estimated that from 50 to 65 per cent of the females and 4 to 6 per cent of the males are needed to perpetuate the breeding herds. The average interval between generations or the average age of the parent when the offspring are born is four to four and one-half years. The period of usefulness of an individual cow in the average dairy herd is comparatively short.

PEDIGREE

Quite generally the use of the word "pedigree" is reserved for purebred animals, or those registered in the recognized herd book of the breed. The word in its broadest sense may be applied to any individual, for it is a statement of the ancestors. A pedigree reveals in its simplest form those related to the individual through its parents. It is a statement of the sire and the dam, and their sires and dams, and so on. To be useful in selection, more than the mere name and registration number must be known, since that in itself gives no indication of merit or the lack of it, though to one familiar with a herd or breed the name of the sire and dam may have much meaning. Dairymen have attempted to give more meaning to pedigree by including certain pertinent information. For example, the sire may have a number of advanced register daughters and some advance register sons. The records of some of the individual daughters may be given, and also the average of all daughter A. R. records. As would be expected, only favorable information is included and the records given may be of such distantly related individuals or collateral relatives that they would be of little value in evaluating the animal.

The use of the pedigree in selection is helpful, but since it is not infallible it should be used to supplement other means of animal evaluation such as appearance and performance.

PRODUCTION RECORDS

In the breeding of dairy cattle, much attention has been placed upon production records. It has been assumed that high producers would have possible offspring which in turn

Langwater Peter 218757, A. R.

Born: June 10, 1934

LANGWATER MERRYMAKER

164124, A. R.
31 A. R. daughters, 19 A. R. sons
Langwater Merry Queen 356076, A. R.
164895—705.6—AA
29 A. R. daughters, 30 A. R. sons
14272—674—P
Langwater Merry Queen 268785, A. R.
12450.1—647.6—P
18079.1—895.3—AA
Langwater Duvaux Rose 186829, A. R.
16079.1—895.3—AA
11946.9—588.8—G
16112.4—883.3—A
Langwater Star of May 206490 A. R.
13699.5—585.5—C
17999.7—783.72—A
Langwater Fides 177729, A. R.
14890.4—742.0—D
Langwater Nymph 541423
Langwater Easton's Queen 361142, A. R.
10874.0—583.8—G
11827.0—583.8—G
11827.0—583.8—G
11859.4—583.3—FF
Langwater Colleen 24 373695, A. R.
11925.6—565.3—GG
13867.8—631.9—A
Langwater Annette 356076, A. R.
10874.0—583.8—G
10975.5—582.3—D
Langwater Meadow Lass 424730, A. R.
11630.1—567.4—FF
Langwater Lady Astor 24 396299, A. R.
11464.6—576.6—EE
11464.6—576.6—EE
11464.6—576.6—EE
Valleywood Kathleen 385124, A. R.
12535.7—547.3—E
Langwater Molly 396687, A. R.
9307.1—540.8—GG
Langwater Turquoise 351415
11755.6—534.3—HH
Sons:
11755.6—534.3—HH
Langwater Peter 218757, A. R.
Langwater Ambassador 218197, A. R.
Langwater Countryman 200171, A. R.
Langwater Meadow King 206129, A. R.
Valleywood Vallant 206316, A. R.

LANGWATER VALIANT 51868, A. R.

1st pr. 1925, 2d pr. 1924 Brockton
1st pr. get of sire
Langwater Field Day 1930.
29 A. R. daughters, 30 A. R. sons
12450.1—647.6—P
18079.1—895.3—AA
Langwater Duvaux Rose 186829, A. R.
16079.1—895.3—AA
11946.9—588.8—G
16112.4—883.3—A
Langwater Star of May 206490 A. R.
13699.5—585.5—C
17999.7—783.72—A
Langwater Fides 177729, A. R.
14890.4—742.0—D

LANGWATER WARRIOR 26509.

Sold for \$15,000.
36 A. R. daughters, 47 A. R. sons
Langwater Heritage 77997, A. R.
12690.8—631.6—CC
Sons:
12450.1—647.6—P
18079.1—895.3—AA
Lone Pine Charity 72846, A. R.
17099.5—831.6—A

LANGWATER GENEROUS 41948

A. R.
11834.8—588.33—F
3 A. R. daughters, 4 A. R. sons
Langwater State Gem 22456, A. R.
12600.0—666.4—D

IMP. KING OF THE MAY 9001, A. R.

33 A. R. daughters, 27 A. R. sons
Langwater Hope 27946, A. R.
19882.0—1003.17—A
IMP. LANGWATER LILY 26606.
IMP. R. 427.2—G
7739.2—427.2—G
10290.1—548.7—A
2 A. R. daughters, 5 A. R. sons

IMP. KING OF THE MAY 9001.

33 A. R. daughters, 27 A. R. sons
Langwater Luxury 49484, A. R.
16825.7—825.34—A
FLORHAM PRIDE 20155, A. R.
16835.8—825.34—A
19352.6—824.03—A
2 A. R. daughters, 2 A. R. sons

ITCHEN DAISY'S MAY KING OF

Sold for \$25,000.
Langwater 17549, A. R.
1st pr. aged bull, Calif. 1917.
26 A. R. daughters, 23 A. R. sons

IMP. QUEEN ROSE OF PINE

IMP. COLE 47176, A. R.
12160.7—833.7—A
16888.6—803.01—A
14907.9—789.63—A
2 A. R. daughters, 3 A. R. sons

LANGWATER HOLLISTON 28855.

56 A. R. daughters, 31 A. R. sons
Rockingham Twilight 316681, A. R.
16726.5—845.1—D
IMP. LANGWATER LILY 26606.
IMP. R. 427.2—G
7739.2—427.2—G
10290.1—548.7—A
2 A. R. daughters, 5 A. R. sons

LANGWATER STEADFAST 31672. A. R. Sold for \$25,000. 33 A. R. daughters, 33 A. R. sons Langwater Angela 195134, A. R. 14905.9—830.9—D Langwater Mab 217996, A. R. 14943.0—830.9—D Langwater Fidele 98593, A. R. 16352.0—828.0—A 101850 18956.0—864.0—C Grand Champion Cow, National Dairy Show Sold for \$22,000. Langwater Country Flower 204359 15106.3—790.4—A	LANGWATER DAIRYMAID 26377. A. R. 11782.9—631.5—G 13747.5—670.1—C 13849.2—671.2—A Sold for \$6,150.	LANGWATER ROYAL MASTER A. R. 22 A. R. daughters, 21 A. R. sons Brookmead's Daffodil 73129, A. R. 14991.2—738.13—A	LANGWATER HORATIUS 63071. A. R. Sold for \$16,000. 14 A. R. daughters, 20 A. R. sons. Langwater Devotion 284000, A. R. 13488.4—705.4—F	IMP. ANGULOSA'S BLANCHE OF LANGWATER 110748, A. R. 13562.3—730.4—DD 17032.8—911.7—A 2 A. R. daughters, 3 A. R. sons	IMP. HONORIA'S SEQUEL II 40668, A. R. King's Cup 1913. Peer challenge cup 1916. Sold 1917 for \$776. 47 Am., 15 Int. A. R. daughters 8 A. R. sons.	SEQUEL'S BOUNTIFUL (4038 F. S.) Island A. R. 131 11963.3—613.32—A Dam of 2 A. R. Sons	NORTHERN BOY II (2354 P. S.) A. R. 6 A. R. daughters—Imp. Princess of the Hall 51798, A. R. 14920.4—696.7—A	DAISY OF CAMP TREHARD (3967 F. S.) Com. L. S. August 10, 1910.
LANGWATER PETER PAN 116959. Sold for \$5,600. 2d pr. get of sire Bryn Mawr, Pa., 1933. 1st pr. Jr. get of sire Eastern Breeders' Guernsey Show 1936. 65 A. R. daughters, 3 A. R. sons 14390 water, 1st pr. 311322 14390 water, 2d pr. 311322 Sold for \$1,200. Langwater Aline 264809, A. R. 15415.7—788.7—F Class Leader when made 15415.7—788.7—F 15415.7—788.7—F 12465.6—643.1—BHI 14714.9—785.8—A Broadwater Irene 311321 14185.1—780.6—AHI View's Gertrude 377398, A. R. 11853.4—736.9—EB 12547.6—734.4—CC	LANGWATER BLANCHE 143402. A. R. 12533.7—614.1—F 14917.7—760.4—A 14917.7—760.4—A 3 A. R. daughters, 3 A. R. sons 3 A. R. daughters, 3 A. R. sons 13932.8—651.5—G	SEQUEL'S SLOGAN 4933 E. G. H. B. A. R. King's cup 1918, 1st pr. and Special Farmers' Show 1919. 1st pr. and champion cup R. G. A. S. Whit. 1919. Champion cup 1920. 46 Am. 2d. Eng. 22 Island A. R. daugh- ters, 16 A. R. sons Lily 4th des Omonds (E. G. H. B.) 14158.3—891.9—A	IMP. SLOGAN'S LADY ASTOR OF LANGWATER 149219, A. R. 13018.1—836.3—A 13018.1—836.3—A 3 A. R. daughters, 4 A. R. sons Langwater Lady Astor 307378, A. R. 13413.0—734.7—CC Sons: Langwater Northern 113149 Langwater Waldorf 126541 Langwater Slogan 166129 Langwater Astor 198385	LADY ASTOR (12113 P. S.) Dam of: La Page's Betty—English A. R. 3612 9620.76—446.44—A				

Fig. 110. An extended pedigree with a complete record. (From Guernsey Breeders Journal, August 1, 1941.)

would yield well. Such is not always the case. The producing ability of a cow is what she herself will yield and not what she will transmit. In other words, a cow may be productive because of a heterozygous genetic makeup, or dominant factors overshadowing recessives, in which case she is not pure, genetically, for milk production. The recessives may combine to give low production rather than high production to her offspring. It is quite clear, then, that in order to know the ability to pass on factors for high production, the genotype must be known. In our breeding, therefore, we endeavor to establish pureness or homozygosity for the factors which give high production.

Observations on the production of dams and their daughters indicate that the offspring of high or low producers tend to regress toward the average.

PROGENY TESTING

It is evident that the transmitting ability of an individual may be measured by testing an ample sample of its offspring or descendants. Such tests are confounded by the fact that each individual tested represents a sample of inheritance from both the sire and the dam. This is overcome by making several combinations, for example, the testing of the daughters of a bull out of several different cows. Another condition which may affect the interpretation of progeny tests is that of "nick-ing," which is due to the heterozygous condition in which the dominant characters prevail. It has been observed that sires may improve the production in one herd but actually cause a decrease in another herd. The explanation is no doubt in the inheritance passed on by the herd of cows and how it compensates with that of the sire.

BULL INDEXES

Daughter and dam comparisons are made to arrive at a bull index. Direct credit is given to a sire in such indexes for raising the production of his daughters over that of their dams. This is based upon the assumption that the dam's production and her transmitting ability are the same, which is not the case. Such indexes may be helpful in identifying a bull capable of transmitting high production, but they are not infallible guides.

Chapter 20

DUAL-PURPOSE CATTLE

In many situations the specialized dairy type or beef type is not as adaptable to the various needs on the farm or ranch as the intermediate or dual-purpose type. As would be expected, this type is not as economical in milk production as the dairy type and also less efficient in quality beef production than the strictly beef type. Investigations have indicated that herds of dual-purpose cows have higher feed costs than dairy herds of equal milk and butterfat productivity, and one investigation indicated that dual-purpose steers require a larger amount of digestible nutrients for weight increases than beef steers. This kind of cattle raising is centered in the north central states and is adapted to the nonspecialized or general farms in that area. Dual- or all-purpose cattle have never been numerous in the ranching sections where extensive grazing is practiced except as a source of the family milk supply. In the eastern and far western states specialized dairy farming generally prevails, but some dual-purpose and beef herds are maintained.

A surprisingly large proportion of cows mainly of beef or dual-purpose breeding are used to produce a large percentage of the dairy products used on the farms in the corn belt. One estimate in 1929 indicated that beef or dual-purpose individuals made up 40 per cent in Iowa and 52 per cent in Nebraska of the total cows milked for the farm-consumed milk and dairy products. This is because such cows are available on the farms, and specialized dairy cows are not needed to produce the home supply of milk. Although a sizable number of cows are handled on the dual-purpose plan, relatively few of the registered purebred cattle are of the dual-purpose breeds.

Adaptability of the Farm for Dual-Purpose Cattle Production

Dual-purpose cattle are well suited for medium-sized farms where the equipment and labor available are inadequate for

specialized dairy farming. The farm-raised feeds are used for the breeding herd and the calf crop in the dual-purpose plan. If the feeds raised are mainly pasture and forage, the calves are usually marketed as feeders. When sufficient concentrates are grown on the farm the calves are fattened or finished, generally as yearlings. Farms best adapted for the milk and beef herds are those which have insufficient labor and equipment to warrant the maintenance of a dairy herd and with insufficient production of



FIG. 111. Model type milking Shorthorn bull.
(American Shorthorn Breeders Association.)

feed, both roughage and concentrates, to justify a specialized beef breeding herd. Beef cattle are best suited to farming conditions where a large amount of feed is available in proportion to the labor supply. If a corn belt farm is not sufficiently large or productive to permit profitable production with a beef herd, a dual-purpose herd of profitable size may be adaptable. A farmer can care for a herd of ten dual-purpose cows and receive a good labor return for full-time employment during the winter months whereas a larger herd of beef cows would be needed for the same employment.

Compared with the strictly dairy type cows the dual-purpose cows are more valuable for beef, more rugged, and require less attention and less protective housing. Also the dual-purpose cows make greater use of roughage and require less concentrate feed.

Dual-purpose cattle permit diversification and are suitable to medium-size farms, where they will provide for the utilization of



FIG. 112. Model type milking Shorthorn cow.
(American Shorthorn Breeders Association.)

farm-grown feeds and surplus labor. Because of this use they are called general farm cows.

Flexibility of Dual-Purpose Cattle Raising

Since neither beef nor milk is the main production, greater flexibility with the dual-purpose type is possible. To some extent it is practical to stress dairying when milk and butterfat are profitable and beef and perhaps veal production when slaughter animals are in demand. Shifts in production may cause the main objective in the breeding program (an intermediate kind) to be altered and the dual-purpose herd so altered

may be less profitable than the specialized beef or dairy herd. The tendency to lean toward the beef or dairy conformation is one of the difficulties to overcome in breeding dual-purpose cattle. A considerable portion of the cost of producing dairy products, milk and butter, is labor. When the income for labor is insufficient, the milk production may be used by the calf crop directly and the labor requirement reduced. With a specialized dairy herd the proportion of cows being milked is relatively high



FIG. 113. Wachess, a noted milking Shorthorn cow. Grand champion at the Eastern States Exposition. Owned by Wachusett Meadow Farm, Princeton, Mass.

and the feed of the farm is marketed principally through the cows. With a dual-purpose herd more of the feed is marketed through cattle other than the milk cows. Beef cattle use nutritive material over that needed for maintenance for gain in weight while in dairy cattle this is used for milk. Dual-purpose cattle stress both purposes.

Dual-Purpose Herd Management

Some, or all, of the dual-purpose cows are hand milked, and their calves are raised on skim milk. The cows so managed

require the same shelter, care, and feeding as specialized dairy cows. Fall calving is the common practice with such herds for the following reasons: (1) Greatest production is during the winter, the time of highest prices for dairy products. (2) The greatest amount of labor is required during the winter when the labor requirement for other farm work is low. (3) Cows and calves can make the greatest use of pasture when it is available. In some situations spring freshening may be preferable because such cows produce most of their milk while on grass and there is less heavy feeding during the winter. Furthermore, on some farms more labor may be available during the summer months.

Methods of Management of a Dual-Purpose Herd

There are many possibilities in the handling of a dual-purpose herd of cows because it is not common to hand-milk the entire herd. Some raisers milk only the best cows and practice double nursing with the calves, while others practice partial milking once a day in the morning after the cows have been separated from the calves since the previous evening, and then allow the calves to run with the cows during the day.

Dual-Purpose Breeds

There are three rather common breeds of this dual-purpose type, the milking Shorthorn, Red Polled, and Devon. In the 1930 Census the enumeration of the registered purebreds indicates that the dual-purpose made up less than 2 per cent of the total for all cattle. The milking Shorthorns are registered in the same herd book as the beef Shorthorns (American Shorthorn Breeders' Association). The only designation of the registry certificate is that it bears the words "Milking Shorthorn." A separate association, the Milking Shorthorn Society, deals with problems pertaining to this division of the breed. A record of merit is kept by the breeders association based upon milk and fat production.¹ The Shorthorn breed was, at its beginning, dual-purpose in type rather than beef. Soon after this formative

¹ A milking Shorthorn bull at the U.S.D.A. Beltsville station has been progeny tested for both beef and milk. Eighteen of this bull's daughters have a total of 23 records averaging 7887 pounds of milk and 308 pounds of butterfat; 15 steers sired by this bull on a record of performance test averaged 1.55 pounds daily gain for a 247-day period, dressed 56.7 per cent, and had a carcass grade of medium.

period separation became evident. Thomas Bates, who started in Shorthorns in 1800, stressed milk qualities and developed the two-purpose type. Later the beefiness of this breed was again emphasized with the development of the "Scotch Shorthorn." Amos Cruickshank, the greatest of all Scotch breeders, began with beef Shorthorns in 1837 and he is credited with being the "refounder" of the breed. Dairy Shorthorns in England are



FIG. 114. A milking Shorthorn cow, Trixie 3d of Wachusett Meadow, taken at 12 years of age. This cow has a lifetime record of 128,584 pounds of milk and 5982 pounds of fat. Owned by Wachusett Meadow Farm. (Photograph courtesy of Paul Beardsley, Mgr.)

more numerous than the specialized dairy breeds and are the source of a considerable portion of their milk.

The Red Polled Cattle were also developed in England. They are somewhat less numerous in the United States than milking Shorthorns. Although this breed originated about 1815, the name Red Polled was not adopted until 1882. This breed has become widely distributed in the United States. The Devon is less numerous than the two other dual-purpose breeds, and is confined more to the eastern part of this country.

Records Made by Dual-Purpose Cows

The record Shorthorn cow in the United States is Ruth B. 568209 who has a yearly record of 21,641 pounds of milk and 956.7 pounds of fat. Up to June 1937, there were 7835 records for Shorthorn cows in the Record of Merit. Records of 7156 cows of all ages showed an average of 327 pounds of fat and an average butterfat test of 3.94 per cent.



FIG. 115. A mature Red Polled bull of the correct type; weight 2475 pounds. Six times international grand champion. Undeclared on the 1940 State Fair circuit. (Red Polled Cattle Club.)

Melba Fifteenth of Darbalara, a Shorthorn cow in Australia, is credited with a record of 32,522 pounds of milk and 1614 pounds of fat in 1924, a world's record for butterfat production.

Cherry, a grade dairy Shorthorn cow in England, is credited with a milk record of 41,644.5 pounds, complete, April 1939.

Jean Duluth Beauty leads the records in the Red Polled breed with a yearly production of 20,280 pounds of milk and 891.6 pounds of fat.

While records comparable with dairy type individuals are

possible, such individuals approach or actually are strictly of the dairy type. Average milk and fat production are more in keeping with the twofold objective. In 1938, 52 herds of dual-purpose cows in Minnesota cow testing associations averaged 237 pounds of butterfat per cow per year. W. J. Hardy, secretary of the Milking Shorthorn Society, stated that the records show that 10,181 cows of all ages of which 25 per cent were



FIG. 116. A mature Red Polled cow of the correct type. Undeclared in class for two years. (Red Polled Cattle Club.)

yearlings and two-year-old heifers produced an average of 8322 pounds of milk and 341 pounds of butterfat each.

Minimum Production of Dual-Purpose Cows

It is quite obvious that dual-purpose cows must make a certain production if it is to be generally profitable to use them for hand milking. A minimum of 200 pounds of butterfat for the first lactation period and 250 pounds for mature cows is suggested as a lower limit based on a ten-month lactation period. Individuals which fall below such performance should be culled from the breeding herd. It is evident that a record of milk yields

and butterfat test is needed to determine the yearly production, which may furnish a basis for selection.

Feed and Labor Requirements for the Breeding Herd

A standard of feed and labor requirements based upon a study of farm records has been formulated by Crickman, *et al.*¹ In formulating this standard for the beef system, it is assumed that the cow calves in the spring and suckles the calf six to

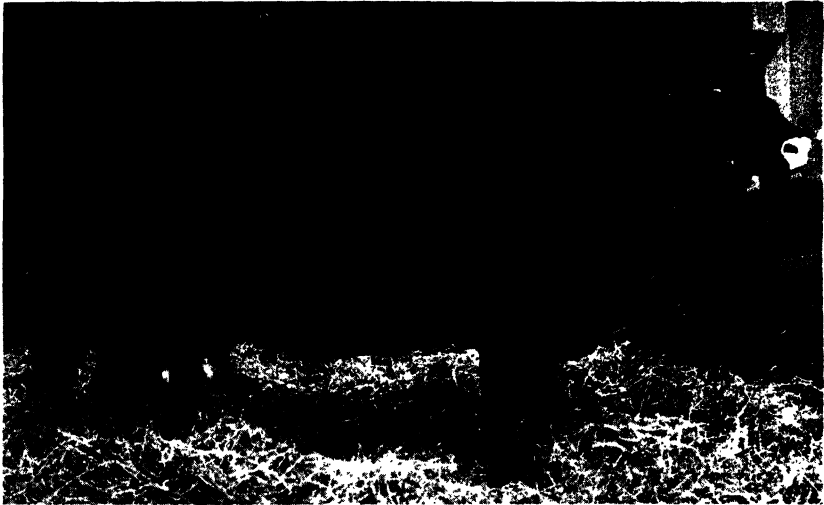


FIG. 117. A three-year-old Red Polled heifer of the correct type. Undeclared in class on the 1940 State Fair circuit. Twice grand champion. (Red Polled Cattle Club.)

seven months. The standard set for the milk and beef system is for a single cow which is milked by hand.

It is assumed that the pasture will consist of $1\frac{1}{2}$ acres of average blue grass pasture, or its equivalent, cornstalk pasture, for one month, and also that straw will be fed.

It will be noted that where the meat and milk plan is followed, more feed (hay and fodder and concentrates) is needed per cow. Also considerable more man labor is needed.

¹C. W. Crickman, George A. Sallee, and W. H. Peters, "Beef Cattle Production in Minnesota," *Bull.* 301, University of Minnesota, 1934.

STANDARD AMOUNTS OF FEED, LABOR, AND CASH COSTS
PER HEAD PER YEAR FOR BREEDING HERD

	<i>Beef System</i>	<i>Milk and Beef System</i>	<i>Bull</i>
Number of head per farm	20-30	10-20	1
Weight of calf at weaning, pounds	400		
Butterfat produced per cow, pounds		160	
Grain, pounds		1000	730
Hay and fodder, pounds	3000	3750	3000
Pasture, including cornstalks, days	225	225	225
Man labor, hours	20	110	30
Horse work, hours	3	4	2
Veterinary, medicine, salt, etc., cents	20	20	20

Relative Profits from Dual-Purpose and Dairy Cattle

The loss of milk production in "beefy" cows must be offset by the greater beef value of the calf crop if such cows are to make as good returns for the feed consumed. If the calves are not



FIG. 118. Red Polled cow, R. L. Josephine, owned by Reynolds, Lybrook Farms Company, Advance, N. C. This cow produced 15,310 pounds of milk and 772 pounds of butterfat in a year.

fattened out or finished, this higher sale price because of beef value will not be attained. That such is the case was indicated by a recent study in Iowa involving dairy and some dual-purpose herds. In several of the dual-purpose herds the calves were

carried to the long yearling stage mainly on roughage and then sold as feeders or as medium-grade slaughter cattle. From this study it was apparent that calves without grain cannot make as profitable use of roughage as milk cows. Even the low-producing dairy herds had a higher return for feed consumed than the dual-purpose herds. Studies made on farms indicated that the specialized beef or dairy cattle herds give a larger net return



FIG. 119. Milking Shorthorns in the pasture. Powell Farm, Ionia, Mich.

than the dual-purpose herds. One investigation indicated that the feed cost averaged somewhat higher on dual purpose herds than on specialized dairy herds in the same production range.¹

Characteristics of the Dual-Purpose Type

The ideal of the dual-purpose cattle breeders is midway between that of the dairy and beef types. Briefly stated, the typical dual-purpose bull or cow should be less thick than the

¹ W. H. Peters, J. B. Fitch, H. R. Searles, and W. E. Morris, "Dual-Purpose Cattle," *Extension Bulletin* 203, Agr. Ext. Division, University of Minnesota, 1939.

beef type and not as lean or angular as the dairy type. In *size* the desired kind is intermediate. Extremes in either direction are to be avoided. For mature individuals in moderate flesh a breeding cow should weigh about 1200 pounds, while about 1800 pounds is desirable for the bull. A *form* which is straight of line, deep, moderately wide, and with medium length of legs is desired. Off-type beef cattle that are shallow bodied and long legged are not the true dual-purpose kind in form. *Quality* or refinement is typical of the desired type. Smoothness of form and fleshing is stressed, and a clean-cut appearance of the head is desired. Coarseness, as indicated by heavy bone in the shanks, is undesirable. *Fleshing and condition* are less pronounced than in the beef type. Yet a fleshing of moderate thickness throughout is demanded for the ideal. Greater covering of flesh on the shoulder, rib, loin, thigh, and twist than is carried by the dairy type typifies the dual-purpose kind. *Dairy qualities* are demanded, as the dual-purpose cow must indicate capacity for milk production. A good dual-purpose cow is expected to yield up to 20 pounds of milk daily on pasture, or roughage, in addition to maintaining her weight. The cow to comply with the dairy requirement must have an udder of good size, that is well carried, balanced, and shapely, and have even, moderate-size teats.

Chapter 21

SWINE—GENERAL VIEW

The term "swine" is used to designate all domestic animals commonly referred to as pigs and hogs. Often "hogs" is used synonymously with swine. Hogs originated in the Old World and were domesticated before the time of historical accounts. The hog has followed civilized man over the entire world. In some countries swine exist in a semiwild stage, roaming free the year around and feeding mainly on mast in the forests. By domestication, which included confinement and feeding, man was provided with a more uniform supply of meat. John Ashton¹ says of man's use of the hog:

Bred and reared since immemorial time by Nordic and Latin races alike, he has proved a source of inestimable food value to the public, and made riches for his breeders and feeders through the centuries.

Indeed it is no exaggeration to affirm that the energy, initiative, courage, strength and resistance to fatigue and hardship displayed by the great colonizers, pioneers and explorers of the past has been due in great measure to their liberal use of pork products as food.

*Time of Domestication*²

In all probability man's first use of swine occurred during the Neolithic age or before written history, when swine of the type known as turbary or Asiatic pigs were found. They were small, much valued for food, and because they could exist on a woodland diet, they were able to go through the winter much better than other stock. Domestication of swine traces back to about 4900 B.C., for Chinese history relates that hogs were domesticated at that early period. Swine are mentioned in Biblical historical writings as early as 1500 B.C., while legendary and historical accounts mention the keeping of swine in Great Britain as early as 800 B.C.

¹ John Ashton, "A History of Hogs," *Monthly Bulletin*, Missouri State Board of Agriculture, January 1923.

² W. G. Coates, "Pigs and Pig Keeping," *Pig Breeders Annual*, 1936-37.

Fossil remains of the ancestors of the present-day hog have been found in the Pliocene strata of Europe and Asia, and in the Eocene strata of North America and Europe. Fossil remains of a prehistoric relative of modern pigs have been found in Nebraska. The domesticated hog today is closely related to the wild hogs which are found in various parts of the world. These wild hogs are of various types, including the pygmy hog of Nepal, the bush pig of Africa, and the peccary of North America. There is reason to believe that the domestic hog originally looked much like the wild hogs of today. These early hogs were gregarious, often forming large herds. They were very muscular, and their meat was rather inferior in quality. They were fierce fighters, having very large tusks. The young pigs were almost invariably striped with bands of dark brown on the body, much the same as young wild pigs are today. The food of the wild hogs consisted mostly of roots, acorns, and such forage as they were able to secure in the forest.

The domesticated hog seems to have had an origin that involved several distinct races or species, which were crossed. It also appears that swine were domesticated in different regions. Some types of the wild hog became extinct, and it is impossible to say when man first domesticated those which remained. It is known that some of the early explorers found domesticated hogs in the South Sea Islands. The domestication of hogs seems to have been almost universal, for nearly all countries possessed them, and each section developed a characteristic type of hog.

Zoological Classification

Swine belong to the mammals and to the *Ungulata* group, which includes hoofed animals. The order is that of the *Artiodactyla* or those with even toes, and the suborder is the *Suina*. The family is that of *Suidae*, which includes the domesticated hog and the wild hogs. Following are listed the various groups of the *Suina* or swinelike ungulates.

Group 1. *SUINA*. Swinelike Ungulates

Family *Hippopotamidae*. Hippopotamuses

This family contains the hippopotamus and the pygmy hippopotamus, both from Africa. The latter is a dwarf species found only in a restricted area on the west coast.

Family *Suidae*. Pigs

This *Suidae* or pig family contains several interesting pigs, such as the wild boar of Europe; the babirusa from the Celebes which has tusks in both jaws, and the wart hog from Africa.

Family *Dicotylidae*. Peccaries

This family includes the peccaries, which are found only in the American continent. They differ from the pigs of Europe in that they have three toes on the hind feet. Their stomachs are more complicated and they also possess a dorsal gland which is lacking in the *Suidae*.

The "peccaries" of America, common to extreme southern United States, Mexico, and other Central American countries, would appear to be a degenerate type of the wild hog. They are small ratlike pigs and do not respond to domestication.

Origin of the Domesticated Hog

Although the exact origin is veiled in obscurity, it is generally accepted that the domesticated hog of today descended from the European wild boar *Sus scrofa*, and that the first improvement was brought about by Neapolitan, Siamese, and Chinese crosses (*Sus indica*).

1. The wild boar, *Sus scrofa*, has been known in Europe, Africa, and Asia. Varieties existed on every continent except Australia and America. They have become extinct in Great Britain. They varied greatly in different localities. The wild boar is noted for strength, vigor, activity, slow maturity, and long life. They have large, coarse, long heads and snouts, heavy shoulders, short back and loin, light hams, and long legs. The color is a dusky brown or rusty gray color with black spots or streaks. A russet-gray color is common in the young and as age advances becomes a dark chestnut brown with the hair tinged with gray at the ends. The skin is very thick, the hair bristly with a soft woolly undergrowth. The young have light-colored longitudinal bands, giving a striped appearance. Prolificacy and apparent immunity to most diseases are outstanding features of this species.

2. One of the other species of swine is the *Sus indica*, a wild parental form of which little is known. They have different

shaped skulls and different teeth from the *Sus scrofa*. This species includes swine of China, Japan, and eastern Asia. In general, they are small in size, fine, short legged, and blocky, early maturing, rapid fattening, smooth coated, quiet and gentle in disposition. This group is a marked contrast to the *scrofa* in quality, being less coarse and more refined; fine bone, very fine thin hair, and absence of bristles were characteristic features. This species was not prolific and had but a small proportion of lean to fat in the carcass.

Two divisions of this species have been noted:

- a. Chinese—White and black and white.
- b. Siamese—Black and plum color.

3. The Neapolitan, from the *Sus wadituaneus*, a grayish-black breed from Italy, was introduced into Great Britain about the twelfth century for the purpose of improving the English swine. No doubt the Neapolitan carried a good deal of the *Sus indica* in addition to some *Sus scrofa*. Two breeds took form in Great Britain—the old English hog and a breed which originated in the Scottish Highlands. These breeds were modified by foreign blood. The white breeds resulting supposedly owe their characteristics to the Chinese, while the black breeds were dominated by the influence of the Neapolitan hogs.

Present-Day Breeds

Our present-day breeds vary in color and color patterns, size, general conformation, appearance of head and ear, and other points. Prolificacy, early maturity, symmetry, quality, size, feeding qualities, quality of meat, and carcass yields have been the main points improved. Careful breeding, feeding, and selection have been the main factors in the development of our domesticated hog, though very often inbreeding has been practiced.

The domesticated hog will quickly revert to the old type if placed in a suitable environment. Large numbers of wild pigs may be found in the more remote districts of southern United States, Queensland, New South Wales, and New Zealand. In each instance they have reverted from the domestic type. The so-called "razor back" is a typical example of this retrogression.

Introduction of Swine to America

Columbus was the first man to bring hogs to the North American continent. In the second voyage made by Columbus in 1493, hogs as well as other domestic animals were brought from the Canary Islands to Haiti in the New World. Later, hogs were taken by many of the early Spanish explorers to Mexico to the Spanish settlement. Hernando De Soto is credited with the first introduction of hogs into what now is the United States. In



FIG. 120. Junior champion Chester White boar, 1940, Iowa State Fair, Dream Lad. Exhibited by Warren Conner, Glidden, Iowa.

May 1539, De Soto's expedition landed in Florida with 13 head of hogs which later developed into a large drove.

Hogs were brought to this continent by the first settlers from England. The colonists along the Atlantic coast brought hogs with them, as did those who settled in Nova Scotia and Newfoundland.

Growth of Swine Production

The early colonists in America brought hogs with them to supply meat for the diet. Soon production exceeded domestic needs, and pork and lard became available for export. The Connecticut Valley early became a center of hog production.

Very early, pork packed in the northern colonies was exported to the West Indies, where it was exchanged for sugar and rum. The first data on exports were for 1790, and that year 6 million pounds of pork and lard were exported.

As agriculture developed west of the Allegheny Mountains, corn was marketed chiefly through hogs and cattle. Cincinnati developed into a large pork packing center. The midwest grew rapidly as a hog-growing area, and many packing plants were established. With the extension of the railroads, pork packing plants were started at the central or terminal markets. At the time of the first United States census, 1840, the important hog production centers were in the corn growing areas of Tennessee, Kentucky, and Ohio. The use of ice made summer packing possible about 1857, and this facilitated the shipping of pork rather than live hogs.

Hog production expanded rapidly after the Civil War, and prices were very low in the early 1870's. Heavy exportation followed. Our export market was partially closed in 1881 when several European countries prohibited imports from the United States because of alleged infestation with *trichinae*.

Hog production in this country expanded from 1867 to 1923. The expansion was not one of gradual accumulation. There were years when the estimate of hog numbers was lower than that of the previous year, but the general tendency was upward. Since 1923 extreme fluctuations have occurred and the drought of 1934-1935 drove hog numbers down to the lowest point in 59 years. The changes in number of hogs on farms are shown in Figure 121.

Areas of Hog Raising

The growth of hog production in this country was due mainly to the expansion of numbers in the north central states or corn belt states, as illustrated in Figure 122. The great increase in number of hogs was in the corn belt along the border of the great plains. Hog raising has followed corn raising as hogs furnished a profitable market for the corn. The corn belt states produce nearly three-fourths of the corn grown in the United States. The increase in dairying in the west north central states may also account for the concentration of hog numbers in

that area. It appears that the increase in available feeds from the reduction of horses and mules has gone largely to swine and dairy cattle.

In the census of 1940, the enumeration of hogs and pigs indicated that 54 per cent were in the corn belt states and 22 per cent in use in 1940 in the cotton-belt states. The distribution of swine in the United States is shown in Figure 122. The north central states had 62 per cent of the total hog population.

The center of swine numbers, as determined from census

HOGS: NUMBER ON FARMS JANUARY 1, 1867-1941

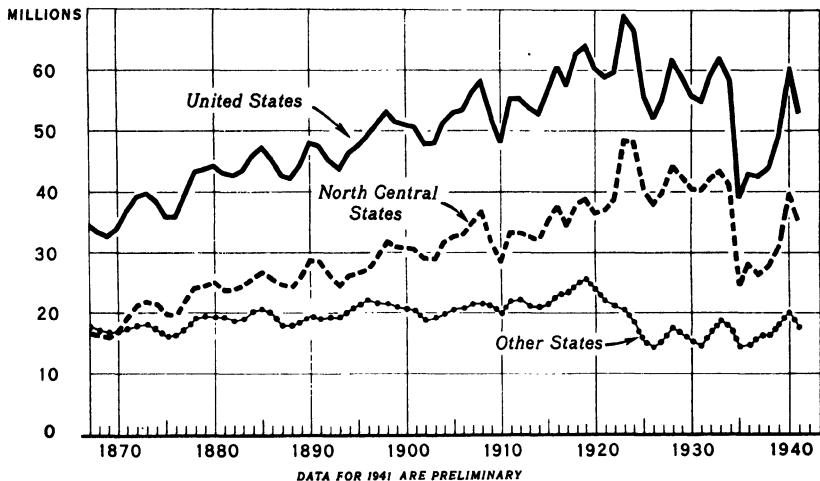


FIG. 121. Hog numbers on farms. Hog numbers change markedly from year to year. There was an upward tendency until 1923, when we reached a peak of production. The increase in hog numbers was mostly in the north central states. (U.S.D.A., Bur. of Agri. Economics.)

reports, has moved westward in each decade. For a time the center moved toward the south, but since 1880 it has usually moved northward, following the northern extension of the corn belt. The center of swine production in 1930 was at Sigsbee, Missouri. The center of human population was at Linton, Indiana, about 280 miles from the swine center.

Hog production is materially influenced by corn yields. When supplies for feeding are short in a section reduction takes place, while a surplus of corn causes an increase in hog raising. It has been estimated that over one-half of the corn produced in the commercial corn growing states is fed to hogs.

Farms and Ranches Raising Hogs

Hogs are widely raised in our country. The 1940 census reported hogs on 62 per cent of the farms. The states in the west north central division (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas) have the largest proportion of farms with hogs, 70 per cent. Iowa is the state with the largest percentage of the farms with hogs,

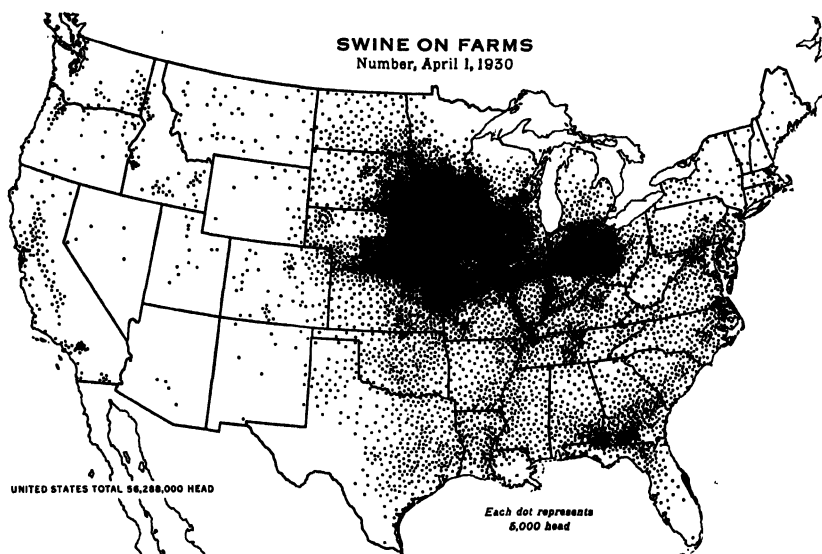


FIG. 122. Swine are concentrated in the corn belt, but are quite widely distributed in farming areas. There are comparatively few in the range areas. (U.S.D.A.)

85 per cent. The geographic division with the greatest number of hogless farms and ranches was the Pacific, where only 20 per cent of the farms have hogs. Connecticut is the state with the lowest proportion of hog-raising farms, about 12 per cent. On the basis of the census report there were 46 hogs for every 100 inhabitants of the United States.

While hogs are found in every state, in very few regions outside of the corn belt are they raised in sufficient numbers for more than local needs. Our commercial supply of pork is mainly from the corn-belt.

Leading States in Hog Production

Iowa is the leading state in hog numbers and has had that position since 1880. The other states have shifted around considerably in rank. Nebraska, for example, ranked second for a ten-year period up to 1933. Extreme droughts caused heavy reduction in that and other of the western corn belt states. A ranking of the states on the basis of a recent period follows. The numbers given are the average of the January 1 estimate for the period 1935-1939 inclusive.

HOGS — NUMBERS IN LEADING STATES,
1935-1939 AVERAGES ¹

<i>States</i>	<i>Thousand Head</i>
Iowa	7,142
Illinois	3,996
Indiana	3,059
Missouri	2,705
Ohio	2,499
Minnesota	2,317
Nebraska	1,887
Texas	1,575
Georgia	1,369
Wisconsin	1,286
North Carolina	1,058
Alabama	1,047
Tennessee	1,038
Kansas	1,034
Mississippi	1,028
United States	43,568

Types of Agriculture and Hog Raising

There are three types of agriculture in which hogs play an important part. In the corn producing areas of the world, hog raising is profitable because the corn is marketed through hogs. Such is the case with our corn belt in the central part of the United States. Corn is also raised extensively in the LaPlata region of South America, and in the Danube Basin of southern Europe. In these corn growing areas, hogs comparable to our so-called "lard type" hogs are raised.

Dairy by-products have long been highly regarded as a feed by hog growers. Hogs are quite common in dairying areas, where they are kept to consume skim milk, buttermilk, and

¹ *Agricultural Statistics 1939*, U.S.D.A., p. 322.

whey, as supplements to the usual basal feeds. Such is the case in northeast central United States and also in parts of Canada, Ireland, Denmark, Holland, South Sweden, and Latvia. A lean type of hog known as the "bacon type" is often raised in dairy sections.

A third type of agriculture in which hogs are involved is associated with the growing of potatoes. Germany and Poland are examples of such a relationship. In this country we have hogs used to some extent to utilize cull and surplus potatoes.

Leading Swine Countries

The world hog population is located mainly in the temperate zones. Originally, swine were found almost entirely in tropical countries. Now they are not numerous in most of the tropical and subtropical countries because of unfavorable production conditions and because available vegetable oils are used to supply the needed fats. China has the largest hog population; however, production in that country is very largely for domestic consumption and only small quantities enter into world trade.

HOGS — NUMBERS IN LEADING HOG COUNTRIES,
1931-1935 AVERAGE ¹

<i>Country</i>	<i>Thousand Head</i>
China	84,000
United States	54,778
Brazil	23,436
Germany	23,434
Union of Soviet Socialist Republics	15,615
France	6,606
Poland	6,546
Spain	5,088
Denmark	4,165
Canada	4,072
Argentina	3,769
Mexico	3,698
Italy	3,264
England and Wales	3,234
French Indo-China	3,217
Czechoslovakia	2,915
Estimated world total	294,700

¹ *Agricultural Statistics 1940*, U.S.D.A., p. 369.

Average of five-year period if available, otherwise for any year or years within the period.

The hog population of the entire world is about 295 million head. About one-quarter of the world hog population is in the United States, which is exceeded in number only by China.

The most important countries in the world trade, because of their exportable supplies or inadequate supply for domestic consumption, are Denmark, United Kingdom, United States, Germany, Poland, and Holland.

A list of the leading countries in respect to number of swine appears on page 334.

Origin of Breeds

Most of the swine breeds raised in the United States were developed in this country. Of the 15 breeds given separate listing

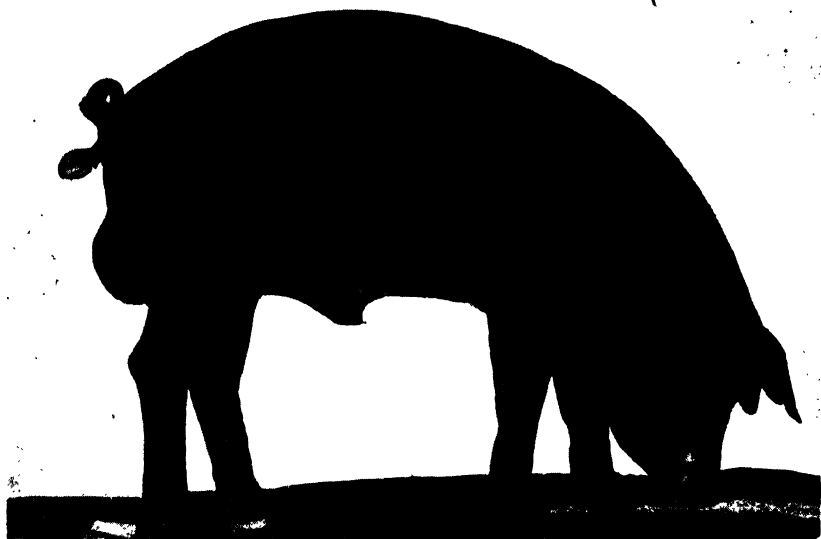


FIG. 123. A good boar pig. A junior champion Duroc boar at the National Show.

in the census report, four originated in England while the remainder originated in the United States. The foundation for most of our swine breeds came from England, with some from China, through England, and also some from Spain and Portugal. Differences between breeds in prolificacy, early maturity, and rapidity of gain have been demonstrated.

Swine Types

Commonly swine are divided into lard type and bacon type breeds. This distinction was based upon the principal objective

in the development of each kind. The typical individuals of each type are distinctive in general conformation, yet the one is not wholly a producer of lard or the other of bacon. Most of our bacon comes from the lard type hog, which includes over 90 per cent of the hogs in this country.

The difference in general conformation between these two types is far less pronounced than it previously was. Since heavily fattened or lardy hogs have been somewhat discriminated against on the market, the proponents of the lard type breeds have stressed leanness.

The lard type was originated in this country to meet a need. Changed conditions, including a lessened domestic demand for fat pork, a decrease in export demand for lard, and an increased use of lard substitutes, have forced a change toward a less lardy hog.

The swine producers have also used the word "type" for description of size in lard type hogs. Accordingly we have small, medium or intermediate and large type hogs. We have also the use of the word type in the market classification of hogs in which fat type and meat type is recognized. The intermediate in size is the most desirable for all interests concerned.

As the domestic market has been the first consideration of the hog grower in the United States, efforts to establish the bacon type breeds and produce English bacon or Wiltshire sides have not been very successful.

Lard Type and Bacon Type Breeds

The breeds in the United States are classified in type as follows:

<i>Lard Type Breeds</i>	<i>Bacon Type Breeds</i>
Berkshire	Yorkshire
Cheshire	Tamworth
Chester White	
Duroc Jersey	
Essex	
Hampshire	
Poland China	
Kentucky Red Berkshire	
Spotted Poland China	
Suffolk	
Victoria	

The above breeds were enumerated separately in the 1930 census. The classification into lard and bacon type is not too well defined for reasons previously given, and there may be some question relative to type status of some of the less numerous breeds. The same census also included a large number of registered purebreds under the caption of "other and unspecified breeds." Since this census, such breeds as the Hereford



FIG. 124. A Hampshire junior sow pig of the approved type, Society Sue, All-American Hampshire junior sow pig, 1939. Owned and bred by Quigley Hampshire Farm, Williamstown, Kans.

hogs have come into some importance numerically and no doubt some breeds listed in the census at one time have slipped into oblivion.

Number of Different Breeds

In the 1930 census, the leading swine breeds in numbers of registered purebreds were, in the order named: Duroc Jersey, Poland China, Chester White, Spotted Poland China, Hampshire, Berkshire, Tamworth, and Yorkshire.

Relatively few hogs (0.6 per cent in 1930) were classed as

registered purebred. About 1 farm in 54 which raised hogs reported registered purebreds. This does not include the many that could qualify in breeding that were unrecorded. During the 1920's there was a marked decline in registered purebreds as the 1920 census indicated there were 3.5 per cent in that class.

Show Ring Classification of Swine

The livestock shows and expositions have two main divisions for swine, breeding, and market or fat hogs. In the latter division, the showing is usually limited to barrows, especially for individuals and pens of three. Litters and carloads of market hogs are comprised of both barrows and gilts. The breeding



FIG. 125. Ten uniform purebred Chester White barrows. These pigs are of the type and finish to top the market.

classes are for purebreds, while in the market classes purebreds, grades, and crossbreds compete. Classification by weights is common, although not universal, in the market classes and usually there is a limitation on the age. Recently there have been some attempts made to broaden swine show classifications by the addition of more classes. In some cases combination classes for groups have been introduced in which both breeding and market individuals are included. Also in some cases on foot and carcass placings are made.

With breeding classes, age classes are used, and the base dates are March 1 and September 1. There are five classes for boars and the same number for sows. On page 339 is a listing of the usual classes.

SHOW RING CLASSIFICATION OF BREEDING SWINE

Boars

1. Aged boar (farrowed before September 1, two years previous).
2. Senior Yearling boar (farrowed on or after September 1, two years previous, and before March 1 the previous year).
3. Junior Yearling boar (farrowed on or after March 1 the previous year and before September 1 the previous year).
4. Senior boar pigs (farrowed on or after September 1 the previous year and before March 1 current year).
5. Junior boar pigs (farrowed on or after March 1 of current year).

Sows

6. Aged sow (farrowed before September 1, two years previous).
7. Senior Yearling sow (farrowed on or after September 1, two years previous, and before March 1 the previous year).
8. Junior Yearling sow (farrowed on or after March 1 the previous year and before September 1 the previous year).
9. Senior sow pigs (farrowed on or after September 1 the previous year and before March 1 of current year).
10. Junior sow pigs (farrowed on or after March 1 of current year).
11. Senior Champion boar, between the first prize winners of classes 1, 2, and 3.
Senior Champion sow, between the first prize winners of classes 6, 7, and 8.
12. Junior Champion boar, between the first prize winners of classes 4 and 5.
Junior Champion sow, between the first prize winners of classes 9 and 10.
13. Grand Champion. The Grand Championship is between the Junior Champion and the Senior Champion both in the boar classes and in the sow classes.
14. The Reserved Grand Champion is included in some show ring classifications of swine. It is the second best individual in the breed of its sex of the show, and it may be the animal second in class to the Grand Champion.
15. Aged Herd owned by exhibitor. A boar and three sows, farrowed before September 1 the previous year.
16. Young Herd bred and owned by exhibitor. A boar and three sows, farrowed after September 1 the previous year.
17. Get of Sire. Four animals, either sex, any age, get of one sire. At some shows, the get need not be owned by the exhibitor.
18. Produce of Sow. Consists of four animals, either sex, any age, produce of one sow.

Chapter 22

THE INTERMEDIATE AND OTHER TYPES OF AMERICAN HOGS

The word "lard" apparently is a persistent one with reference to types in hogs. As has been previously indicated, this term is far less apt than when the term was first applied to our hogs. Present-day market hogs yield about 15 per cent of their live weight in lard. The dietary habits of our first settlers and the demands of our first export trade led to the development of a lardy hog. When our first midwestern farmers developed hog production on a commercial scale, lard and fat pork cuts were in relatively strong demand. A large, well-finished hog that would yield large amounts of lard and heavy pork cuts suitable for barrel pork or dry salt pork was our first market hog ideal. Such hogs could profitably convert corn and other feeds into pork products, highly desirable at that time. Our first developed hogs were vastly different from the English market ideal — suitable for Wiltshire-side processing — and consequently the words "lard" and "bacon" became attached to the two kinds which were then quite diverse in form.

American farmers created breeds of hogs suitable to their needs because the bacon type hog of England failed in several respects to meet American requirements. The so-called lard type was modified as time went on to meet changing conditions. Drastic changes were made in the generally desired type, and the pig responded remarkably to the needs of the times. The capacity for change of swine type or form has been demonstrated time and time again.

What were the forces which caused a shifting from one type to another? The demand for pork and lard is the biggest factor, although the requirements of the hog raisers were not wholly ignored. Such factors as the development of refrigeration, the improvement of curing and processing pork, foreign

and domestic demand for lard have caused changes in the desired type of hog. The producer was concerned with such factors as productiveness and economy of production. Our lard type has shifted to less lard and since 1900 it has also passed through the small, large, and intermediate type stages. We are now back to the intermediate type. Before 1900 the hogs were generally big; however, a few small type herds existed since rather early days in pork production in the midwest.

Present Day Type

The desired type of hog of the present day is neither large nor small, but the intermediate or medium type. This type suits most of the various interests that are concerned with swine type. It is the lard type modified to suit present conditions. Consumer desires reflected through meat dealers to meat packers have shown a strong preference for small pork cuts that are meaty, firm, and not lardy. The producer wants an efficient, rapid-growing, productive hog which will sell well on the market. These specifications are fulfilled to a high degree by the intermediate type. The demands or preferences for pork products are not static or uniform. They vary with localities and change with time. It is therefore evident that there will continue to be fluctuations in the ideal, or type, but for the most part the "middle of the road" kind will be in the greatest demand.

The most desirable market type has been defined as "one which can be produced most efficiently and economically and for which the packing industry will pay a price preference because of a higher carcass value in terms of yield and quality of pork products."

An Illinois study¹ reported in 1935 of the various types of hogs prompted this conclusion:

None of the types of animals included in this study meets effectively the present pork-market demands. The intermediate type approaches the ideal most nearly, with the chuffy, the rangy, and the very chuffy following in the order named. The ideal hog would have the quality and plumpness of the intermediate type, the length of the rangy, and the early maturity of the chuffy.

¹*Bull.* 415, Ill. Agr. Exp. Sta., 1935.

Such was the situation in 1935, which was after the market decline in the value of lard in relation to certain of the pork cuts. Since then breeders have gone even more definitely to the intermediate hog. By breeding and selection the type of hogs can be changed markedly and swine are modified to suit current demands insofar as these are compatible with economical production. With the intermediate type of hog we have sufficient finish at the common marketable weight of 200 to 250 pounds. To such weights this type is unexcelled in economy of gain.

Detailed Description of the Ideal Market Type Hog

The following description applies to market hogs. A description of the requirements of pigs or hogs for the breeding herd is included in Chapter 28.

THE MARKET BARROW SCORE CARD

The purpose of the score card is to describe an ideal individual on foot. The score card is helpful in teaching the student the parts of a market pig and their comparative value. Likewise,

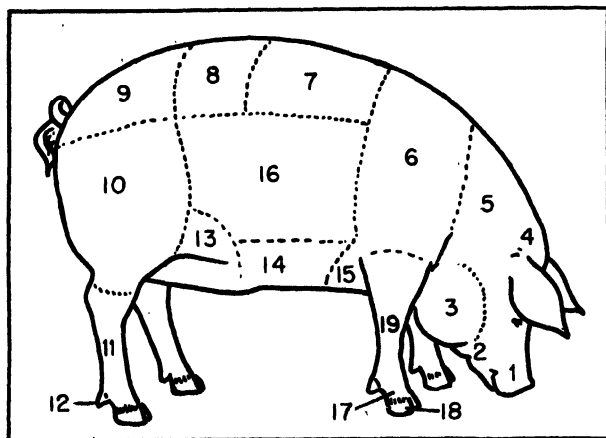


FIG. 126. Parts of the market barrow.

- | | | |
|-------------|----------------|----------------|
| 1. Snout | 7. Back | 14. Belly |
| 2. Jaw | 8. Loin | 15. Fore flank |
| 3. Jowl | 9. Rump | 16. Side |
| 4. Poll | 10. Ham | 17. Pastern |
| 5. Neck | 11. Shank | 18. Toes |
| 6. Shoulder | 12. Dew claw | 19. Fore leg |
| | 13. Rear flank | |

the nomenclature for the description of the parts may be acquired from the score card. From the hog score card we learn, for example, that the back and loin should be wide, slightly arched, rather flat from side to side, and covered with thick, smooth, firm flesh, and that in value these parts represent 12 per cent of the entire hog. Some similarity in names or parts appears between the animal on foot and in the carcass, as can be observed from the figures of the parts of the hog, Figure 126, and of the parts of the carcass, Figure 158. However, they may not be identical and this causes confusion; for example, the shoulder of a hog on foot usually includes more than the pork cut "shoulder."

SUGGESTED STUDENT SCORE CARD FOR A MARKET BARROW

The score card which follows is suitable for a finished market barrow (or gilt) of the intermediate type. It is a description of an ideal market pig which under usual conditions would top the market. The range of weight which will bring the top market price depends upon many circumstances. Supply in proportion to demand caused the top price kind to vary. At times packing sows have sold for higher prices on the market than well-finished young pigs. This would happen only when packing sows are scarce on the markets and when there is a strong demand for that class. It is quite obvious that pork cuts and lard yield would be quite different in a finished barrow at 200 pounds and a packing sow at 350 pounds. To a degree, they are interchangeable, but they differ widely in size, weight, and leanness of the loin, bacon belly and ham. The pork cuts from pigs marketed at weights from 200 to 250 pounds are most acceptable to the trade.

The market barrow is taken as the ideal for the score card description because it represents the top market class. Actually barrows and gilts at comparable weights and quality sell at the same price, much as do ewe and wether lambs in market mutton sheep.

The score card is used mainly in teaching, because through its use the entire animal may be studied, and a systematic consideration of the various parts made. Seldom are score cards used in selection or judging.

Market Barrow

*Scale of Points***GENERAL APPEARANCE — 42 points:**

1. **WEIGHT** — according to age
6 months 200 pounds
9 months 320 pounds
2. **FORM** — moderately long, deep, wide; top line slightly arched; underline and sides straight; trim middle, balanced, stylish; legs squarely placed
3. **QUALITY** — smooth in form and finish; free from wrinkles or flabbiness; head and ear medium fine; bone medium size; hair not coarse, bristly, or curly
4. **CONDITION** — degree of fatness, indicated by a moderately thick, firm covering of flesh over all parts of the body, not excessively fat
5. **DRESSING PER CENT** — or carcass yield — indicated largely by condition and trimness of middle

HEAD AND NECK — 5 points:

6. **SNOOT AND FACE** — medium length, wide, clean cut, not coarse
7. **EYES** — wide apart, open, not small
8. **EARS** — medium size, fine texture, wide apart
9. **JOWL** — smooth, neat and trim, not flabby
10. **NECK** — medium length, smooth, blending neatly with the shoulders and head

FORE QUARTERS — 9 points:

11. **SHOULDERS** — smooth, blending smoothly into the sides, not wider than back and hams, compact on top, well fleshed
12. **CHEST** — wide, deep, full
13. **FRONT LEGS** — medium length, straight, bone medium size, pasterns strong

BODY — 28 points:

14. **BACK AND LOIN** — wide, slightly arched, rather flat from side to side, covered with thick, smooth, firm flesh
15. **SIDES** — moderately long, deep, smooth; free from wrinkles; flanks well let down
16. **BELLY** — straight, trim, free from flabbiness

HIND QUARTERS — 16 points:

17. **RUMP** — long, wide, slightly arched but not drooping, rather flat from side to side
18. **HAMS** — wide, deep, full, heavy, firm, shank short
19. **HIND LEGS** — medium length, straight, bone medium size, pasterns strong

SCORE CARD POINTS

The detailed points of the score card and a brief description of each follow. For the most part, it would seem that the points of the score card pertain to the carcass and that the standard of perfection is a statement of the meat packer's requirements. However, the twofold ideal is considered in its making, and the resulting ideal is highly acceptable to the raiser. In the main, the hog raiser can produce a top hog as cheaply as an inferior one and if the pig is up to standard in weight for age, efficiency of production is generally assured.

I. GENERAL APPEARANCE. The general appearance rating is divided for convenience into weight, form, quality, condition, and dressing percentage. Nearly one-half of the value of a market hog is determined by general appearance. Perhaps this is an undervaluation, because as compared with sheep and cattle more of the value of the slaughter pig is appraised with the visual examination, and this mostly in a general way rather than a critical examination of each part. The swine judge or

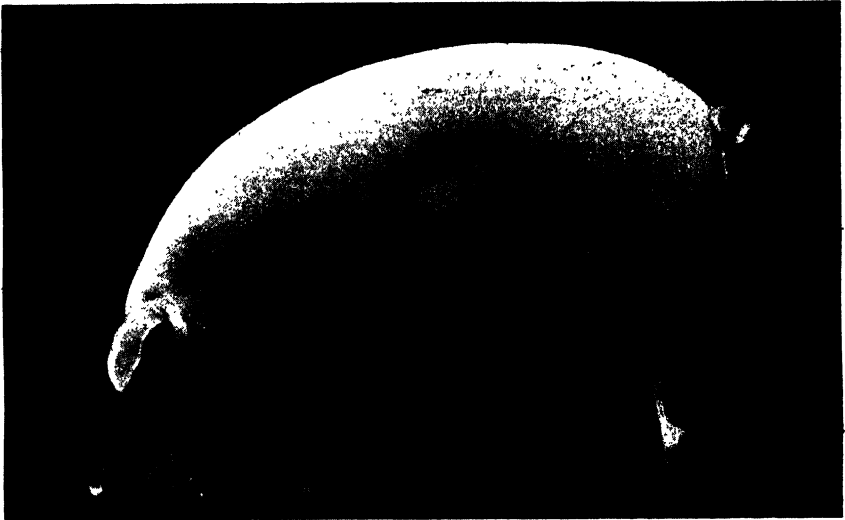


FIG. 127. Grand champion barrow at the Iowa State Fair, 1941. A pure-bred Chester White, owned and shown by J. B. Seehusen, Center Junction, Iowa. (R. L. Pemberton, Iowa Swine Producers Ass'n.)

hog buyer does not handle market pigs to determine fleshing as is done with steers or wethers.

a. Weight. Weight for age is the most important single point on the score card from the producer's viewpoint. Rapid gains are economical gains, and hogs are sold on the basis of weight rather than on other considerations. It has been found that the feed required for 100 pounds gain decreases as the average daily gain increases. In other words, slow gains require more feed than fast gains. A pig making a gain of 1 pound a day from weaning time to a weight of 225 pounds will require about 430 pounds of feed (concentrates) to make 100 pounds of gain

in dry lot. If the gain is speeded up to 1.5 pounds per day, the requirement would be reduced to 375 pounds of concentrates.

Slow-gaining pigs are less attractive to the packer than fast-gaining pigs. The former are generally long legged and lean in conformation. Fast-gaining pigs are usually plump, thick, and healthy appearing, and are relatively young when finished.

Weight is a factor in market price as previously indicated, yet it is usually more economical to have a fast-gaining heavy

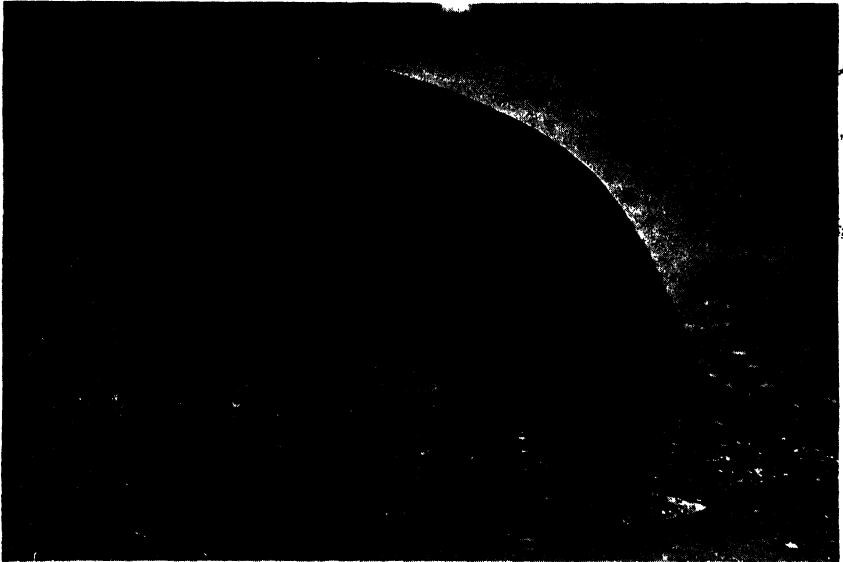


FIG. 128. Duroc barrow. Grand champion barrow, Southwestern Exposition and Fat Stock Show, Fort Worth, Texas, 1941. Sold to Swift and Co. at weight of 240 pounds at \$1.85 per pound. Bred, fed, and exhibited by the Texas Agri. Exp. Station, College Station, Texas.

pig than a slow-gaining light pig, even though the light pig may be in a weight range quoted at the higher price. This is, of course, with pigs of comparable ages.

There are breed differences in weight for age; also the gilts are slightly lighter than the barrows. For a minimum standard to be acceptable a weight of 200 pounds is suggested for the six months old pig, and 320 for a nine months old pig. A good pig should weigh, after four months of age, nearly 1.2 pounds for each day of his age—that is, if full feeding has been practiced.

b. Form or Conformation. Type, as used in swine, is mainly a matter of form; for example, a pig may be described as being long, tall, narrow, and shallow, or at the other extreme, short, low set, wide, and deep. The first terms describe the rangy or extremely big type, while the second describe the small type. As the intermediate is the desired type, we stress moderation of the specifications. Therefore, when finished the market barrow is moderately long, deep, and wide. A slightly arched top line, straight side lines and bottom lines, with resultant trimness of middle, and balance are included in the description of form. Stylishness and well-set legs are also desirable.

c. Quality. To comply with the ideal in quality, smoothness of form and fleshing, absence of wrinkles, creases, flabbiness, or unevenness in the fleshing or skin are stressed. Refinement of the bone, head, and hair are also required. In its descriptive use, quality means refinement, or lack of coarseness. On the markets, quality is a more widely used term and implies general goodness.

d. Condition or Finish. The fatness or finish that is desirable is dependent upon the relative price for lean cuts and the fat cuts and lard. Lean cuts are higher priced than the fat cuts, but a certain amount of finish or fat is needed to make the lean cuts acceptable. The fat improves the quality and cooking properties of the meat within limits and it also increases dressing per cent. A certain amount of fat is essential for the best cured pork cuts such as bacons and hams. Overfat hogs are penalized less on the market than underfinished hogs, largely because the fat can be trimmed off, and cuts too lean cannot be improved. The fat from hogs has a higher value than that of other farm animals, yet heavy yields of lard may be objectionable and the lean cuts of pork are in the greatest demand.

A moderately thick, firm covering of flesh over all parts of the body is ideal as regards condition. Width of body, plumpness of the hams, jowls, and flanks indicate condition. Pigs lacking in condition are narrow, shallow, and show a generally insufficient covering.

Hog carcasses of the top grade are required to have a uniform layer of back fat about $1\frac{1}{2}$ inches thick, which can be readily observed when hog carcasses are split.

e. Dressing Percentage. The carcass yield determines to a large degree the value of a slaughter hog. When killing tests on slaughter hogs go no further than the yield, the overly fat hog has an advantage, as fat hog dresses high, but overly fat carcasses are usually worth less than leaner carcasses. A trim middled, highly finished hog has a high carcass yield.

2. HEAD AND NECK. The head and neck are of far less importance on the score card than the other divisions. The packer wants a minimum of this division because it is largely cheap meat

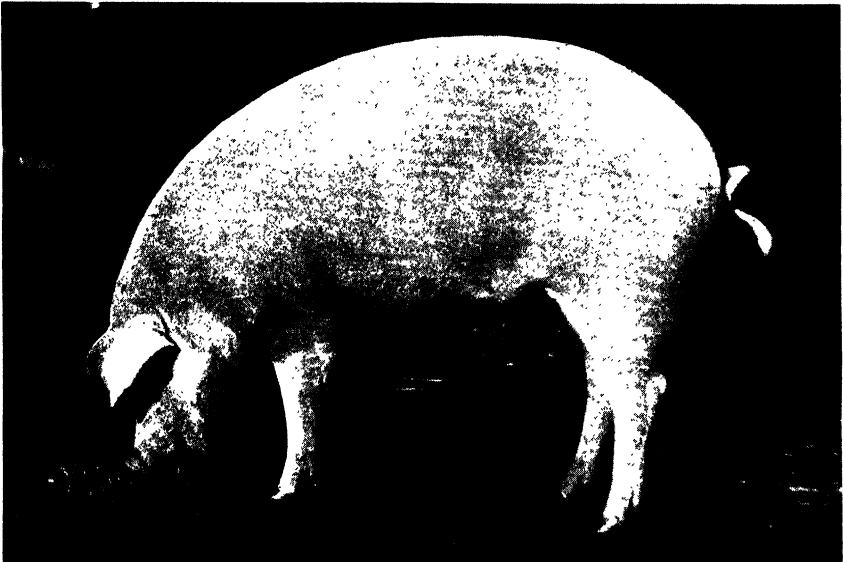


FIG. 129. A model Chester White barrow, grand champion at the American Royal, 1940. Shown by Oklahoma A. and M. College.

and by-products. Therefore, medium size of the head and neck is desirable and coarseness is decidedly objectionable. The head should not be long and narrow. Eyes that are fairly prominent, clear, and bright are desired. The ears are to be medium in size. Trimness and neatness of the jowl are stressed. Very heavy, coarse jowls are not wanted, as this part is the source of a relatively cheap pork cut. The neck should be of medium length and well blended with both the head and the shoulders.

3. FORE QUARTERS. The fore quarters are divided into the following parts on the score card: shoulders, chest, and front

legs. Of these parts the shoulder receives the greatest emphasis. Briefly, a smooth shoulder, blending smoothly into the sides and neck and not wider than the back or hams, compact on top and well fleshed, is wanted. A wide, deep, full chest indicates a strong constitution as does a fullness or lack of depression just back of the shoulders. Front legs, to be highly acceptable, are to be medium in length and size of bone. Straight legs with strong, rather short pasterns are desired.

4. BODY. In aggregate value the body is exceeded in credit



FIG. 130. A Berkshire barrow of the desired market type. Champion Berkshire barrow at the 1940 International Livestock Exposition. Shown by Moore Bros., Barrington, Ill.

only by general appearance. It is the source of the higher priced cuts and also is the heaviest part of the carcass. A back and loin which is straight or slightly arched, wide, rather flat from side to side, and carries a smooth covering of thick, firm flesh, is in demand because from it comes a good pork loin and fat back. Sides that are moderately long, deep, smooth, free from wrinkles, and have flanks well let down make high-class bacon if of the right weight and sufficiently lean. A straight, trim belly free from wrinkles adds to the bacon cut.

5. HIND QUARTERS. The ham is the most important part of the hind quarter. The rough pork cut on the carcass comprises

both the ham and the rump. A long, wide rump continuous with the conformation of the back and loin, and blending into a wide, deep, plump, short shank ham is desired. Excess fat or flabbiness on the ham is to be avoided. Hind legs properly set, of medium length and with medium-sized bone meet the requirements.

The word description of the market hog is helpful in establishing a conception of that ideal. Properly to establish the ideal and to have it more generally understood, illustrations, drawings, photographs, and live animals are essential.

Additional Characters Emphasized in Breeding Hogs

Market or fat classes are placed according to their perfection as a profitable market hog, while breeding hogs are selected for the main objective, which is the ability to produce good market hogs. In breeding hogs less emphasis is placed on finish and dressing percentage, while constitution, feet and legs, and breeding qualities are given relatively more emphasis.

The selection of boar and gilts for the breeding herd are discussed in Chapter 28.

Swine Judging Observations

Properly to evaluate an animal we must know the various parts and also their relative value. The score card is helpful in becoming familiar with the parts and their merit. In evaluating an animal, it is best to consider it first as a whole and then consider the different parts. Observance of swine should be made from some distance — 12 to 25 feet. The inspection should cover not only the side view, but also the front and rear views. Closer examination should follow to make a detailed and careful study.

Other Swine Types

The type previously described predominates in our country, but we have other rather well-developed types, some of which border on the intermediate.

BACON TYPE

Although our numbers of bacon hogs are not large, the bacon hog is given a separate chapter because of the difference both in



FIG. 131. A small type market pig. Such pigs are finished at light weights but have a high lard yield.

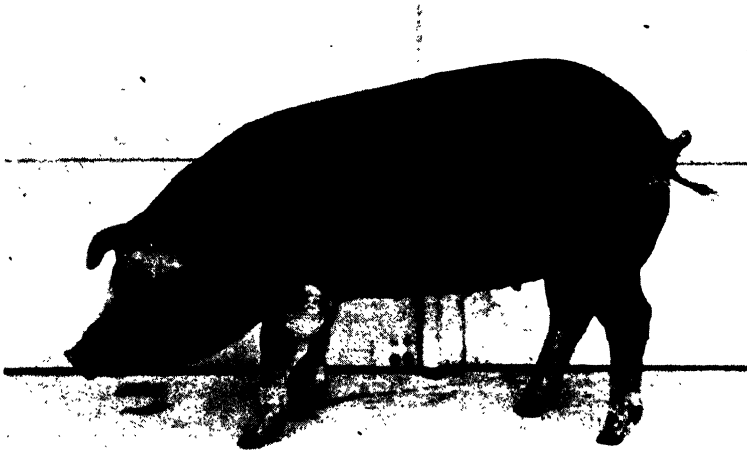


FIG. 132. A large or rangy type market pig. Such pigs must be carried to rather heavy weights to have sufficient finish.

feeding and processing, and also because of its importance in other countries.

THE SMALL TYPE

This type prevailed from 1895 to 1912. Its main disadvantages for our general use are:

1. Lard yields when they are finished are relatively high.
2. If very small, hogs may be unsuited for average farm feed lot conditions, under which some size and ruggedness are worth-while attributes.
3. The sows lack in prolificacy.

On the other hand, this type has certain points in its favor, some of which are:

1. They are finished for the market at light weights.
2. The sows are small and require less feed for maintenance and less space in housing.

THE RANGY OR LARGE TYPE

When there is a strong pressure for poundage of pork, large hogs come into prominence. This was very pronounced after



FIG. 133. A lot of intermediate type market pigs. Berkshire barrows, sweepstakes ten barrows, International Livestock Exposition. Bred and exhibited by Pennsylvania State College.

the first World War. Of course there are various degrees of bigness. The demand from 1920 to 1923 was for the extremely big type; since that subsided, the emphasis has shifted to the intermediate hog. Some of the advantages of big hogs are:

1. They can be carried to heavy weights when necessary.
2. At lighter marketable weights their lard yield is comparatively low.
3. The sows are prolific.



FIG. 134. Market barrow carcasses, sweepstakes carcasses at the International Livestock Exposition. From the barrows shown in Figure 133.

Some of the objections to the big type hog are:

1. They are unfinished at desired marketable weights. Extremely large pigs continue to grow for a longer time and are slow to finish.
2. The pork cuts from the pig of sufficient finish are too large for the general demand. For example, at the desired size, the bacon belly may lack finish, firmness, and thickness.
3. The breeding stock is of large size, requiring a relatively large amount of feed for maintenance and a large amount of housing space.
4. Some of the pork cuts are poorly proportioned for the trade. This is especially true of the long-shanked "banjo" ham.

THE MEAT TYPE

Commonly this term is applied to the type which has a high cut-out value or meets the demands of the consumer to a high degree. This term had its origin among the market hog men

rather than producers. It sometimes is referred to as "butcher type." It is not synonymous with bacon type. It has become a part of the hog market classification in which hogs are divided



FIG. 135. Berkshire barrows, a champion pen at the International Livestock Exposition.

into meat type and fat type. These are two grades of slaughter hogs on the market, but both may produce top-grade carcasses. They differ in the proportion of fat to lean and produce different

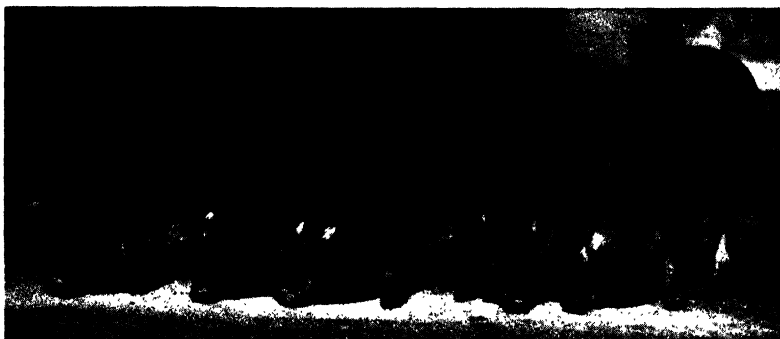


FIG. 136. Five heavyweight Duroc barrows. A winning get of sire at the International Livestock Exposition.

proportions of the primal cuts. The meat type, briefly described, is moderately long, wide, and deep in relation to the weight, while the fat type is wider and shorter.

Feeding Affects Type

The type, small, intermediate, and large, is affected in part by feeding and management. The pattern for type is set by inheritance, but the fulfillment depends upon nutrition. The size and weight a hog will attain at maturity are set by its heredity but may be affected by feeding. Pigs fed heavily are finished at lighter weights than pigs fed limited rations. Large type or rangy pigs may yield quite acceptable carcasses when they are self-fed, especially if corn is the basis of the ration.

Chapter 23

BACON TYPE HOGS

Bacon type hogs have a distinctive form or conformation which is readily distinguished from the common types on our markets. We raise some strictly bacon type hogs and there have been several attempts to establish this type, especially in our dairy states, but as yet the numbers raised have been comparatively small. In the slaughter hog schedule in our market classes and grades of swine, there is no longer a class for bacon hogs as was once the case.

Bacon hogs are of especial importance in Canada, Denmark, Great Britain, and Ireland. The main demand for bacon of this type has been from the English market. This market is very exacting in the Wiltshire requirements both as to the qualities of the side and the method of curing. England produces about one-half of the pork that its people consume. The most popular cut of pork on the English market is the Wiltshire side or Wiltshire bacon. A Wiltshire side is a half of a dressed hog carcass with the backbone, aitch bone, shoulder blade, and feet removed. The entire side is given a mild cure and is smoked in one piece. There is some variation in the manner of cutting Wiltshire side.

The hogs raised in England may be used for fresh pork or cured for bacon which are two different things. The pork pig is slaughtered at lighter weights, usually about 80 to 100 pounds, and is disposed of as fresh pork. This production is mainly from the home pig industry, and the demand for such pork is more limited than that for bacon. The English demand for Wiltshire bacon is for the most part supplied by imports from Denmark and Canada. In England, the early-maturing breeds suitable for killing at light weights, such as the Middle White and the Berkshire, are preferable for fresh pork, while the Large White and Tamworth are suitable for bacon and are usually

slaughtered at a live weight of 200 pounds. The bacon type has been defined as that suitable for Wiltshire side production.

Bacon Type and Intermediate Type

The leaner kind of intermediate hogs, or those that would class as meat type on our market, will produce a large proportion of acceptable Wiltshire side. To qualify, such hogs must be between 200 and 220 pounds in weight and of suitable conforma-



FIG. 137. A model bacon type barrow. Champion Tamworth barrow at the 1940 International Livestock Exposition. Owned by Guy W. Baker, Shelbyville, Ill.

tion and finish. Intermediate type hogs,¹ with good length, smooth shoulders, plump hams, and a considerable degree of smoothness and quality, if marketed at the proper weight and finish, will yield a good percentage of carcasses suitable for conversion into Wiltshire sides. This type of hog can be found in practically all the American breeds.

Dressing the Bacon Hog

Hogs dressed for Wiltshire sides will yield about 60 per cent of exportable bacon with a usual range from 56 to 64 per cent. A

¹ R. E. Hutton and E. Z. Russell, "Production of Hogs Suitable for Wiltshire Sides," *Circ.* 532, U.S.D.A., 1939.

200-pound pig will therefore yield two sides weighing about 60 pounds each. The yield is lower than for regular dressing, like packer style, because of the greater trimming needed for the Wiltshire.

Hogs that are used for making Wiltshires are singed on the killing floor after dressing. This is done by a torch arrangement and the side is evenly singed but not burned. A properly singed skin is a light golden-brown color and tender enough so that it can be readily punctured with a toothpick. Often hogs suitable for the export trade are called "singers" or "Canadian



FIG. 138. A model Yorkshire barrow, champion Yorkshire at the 1939 International Livestock Exposition. Bred and exhibited by the University of Wisconsin.

singers." The side when dressed for a Wiltshire has the fore leg cut off at or above the knee joint and the hind leg at or above the hock joint. The shoulder ribs, neck bone, backbone, aitch bone, skirt, and loose fat are removed. The breast bone is sawed or cut down smooth and even with the face of the side. The belly is neatly trimmed and the side is squared on the neck. The Wiltshire side is placed in a brine solution for about four days for curing. After it has been in the cure the side is allowed to drain for three or four days. The sides are wrapped, usually four in a bail, and then exported to England where they are smoked before marketing.

Wiltshire Requirements

In Canada the requirements for the grading of hog carcasses are very well defined. Government grading of carcasses is mandatory and since September 30, 1940, this has applied to the carcasses of hogs at all establishments slaughtering 3000 or more hogs per year. Prior to that time, about 60 per cent of the hogs slaughtered were graded on the rail by government graders and settlement was made on weight and grade of the carcass. The carcass grading was started in 1934 on a voluntary basis.



FIG. 139. Tamworth barrows of the proper finish for marketing. A champion pen of Tamworths at the International Livestock Exposition.

Canadian grade standards are based on the requirements of the export market for Wiltshire sides. The type and quality of hog suitable for this trade was found to be highly acceptable for their domestic trade. In the grading of carcasses five grades are included. The top grade is "A," commonly called "selects." There is only one class in this grade, and the weight range is from 140 to 170 pounds. The minimum length is 29 inches and the measurement for length of the carcass is taken from the front edge of the first rib to the inside of the aitch bone. The maximum fat on shoulders is two inches, which

measurement is taken at the point of maximum fat thickness on the shoulder, except for any small fat infiltration into the lean. The maximum fat on the loin is one and one-half inches, which measurement is taken at the point of maximum fat thickness on the loin between the last rib and the tail.

The carcasses in the grade A are described as follows: All carcasses shall be of best quality. Shoulder — shall be balanced in weight in relation to the ham. Belly — thick and of even width throughout, with full flank. Ham — full fleshed, evenly covered with fat, and of good shape. Back — fat firm and of even thickness within variation allowed. Quality — fat firm



FIG. 140. A pen of Canadian Yorkshire barrows. The Yorkshire is the predominating breed in Canada (J. W. G. MacEwan, Saskatoon, Canada).

and white with proper balance of fleshing and fat in carcass throughout.

Firmness of fat is of a high degree of importance in grading Wiltshires. A slight softness will disqualify a carcass from the grade A for Wiltshire sides. Lack of maturity, lack of finish, or too much softening feed, such as soy beans, will cause softness. Unbalanced rations, such as too much corn, lack of exercise, or unthriftiness, may cause the carcass to lack sufficient hardness. The other grades are for carcasses less acceptable to the trade. Grades B, C, and D have three classes each, which are weight divisions, and grade E includes carcasses that are unfinished or oily, rejected or condemned, with physical injuries, stags, or ridglings. Grade B, like A, is a "bacon grade for export" while C, D, and E are "pork grades" for the domestic market.

The predominating hog breed in Canada is the Yorkshire. It has been estimated that over 90 per cent of the hogs of that country are of Yorkshire breeding.

Retail Cuts from Wiltshires

In England the Wiltshire sides are converted at the butcher shops into cuts or joints for the retail trade. There is variation

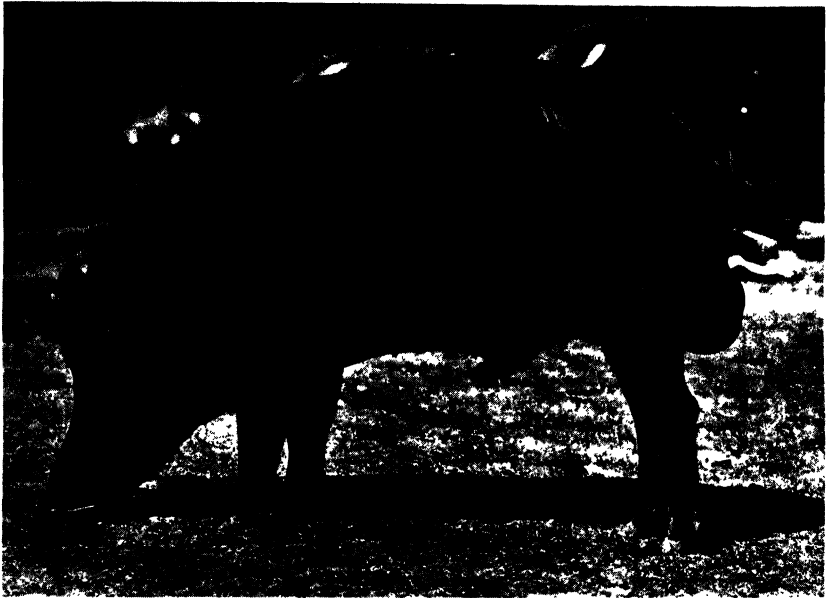


FIG. 141. A champion Tamworth boar, G. V. Prince 1st. Owned by J. M. Dowell and Sons, Mahomet, Ill.

in the manner of cutting, about nine or ten cuts resulting, and these cuts vary in weight, but with the usual side they range from three to ten pounds. The following cuts are common: gammon hock, flank, thin streak, thick streak, forehock, corner gammon, large loin, back and ribs, and collar. The gammon or ham is the highest priced cut. The flank (a small piece below the loin and ahead of the ham) and forehock, which is comparable to our picnic cut, are low-priced cuts. The common cuts of a Wiltshire side are shown in Figure 142.

Some of the cuts from the side of bacon are prepared by boil-

ing, but the greater part are fried. Cuts in greatest demand, therefore, are those which can be sliced and which will not break up and lose their shape in frying. The slices or rashers then should be a convenient size for frying and also have the proportion of lean and fat desired.

We use a considerable amount of so-called "Canadian bacon" or "Canadian style bacon." It is a domestic product from hogs

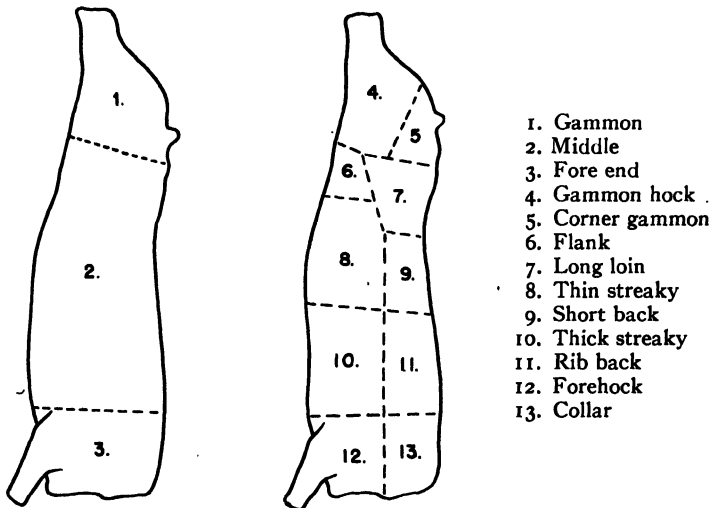


FIG. 142. Cuts of a Wiltshire side

of intermediate type and is the boned loin cured and smoked in the same way as our regular bacon.

Price Comparisons on British Markets

Not enough of our Wiltshire sides are exported to England to give a basis for price comparison with those of other countries. However, we do export bacon sides and hams, which generally sell for less than the Wiltshire side of their own production or those imported from Denmark. A comparison of bacon and ham prices on English markets for a five-year period follows:

BACON AND HAMS, GREEN FIRSTS.
AVERAGE WHOLESALE PRICE PER HUNDRED POUNDS
AT BRITISH MARKETS, 1935-1939 AVERAGES¹

Bacon, Wiltshire Sides at Bristol

British	\$21.72
Canadian	19.51
Danish	21.41
Dutch	20.61

*Bacon, American Bellies, at
Liverpool*

\$15.84

*Ham, American Short Cut, at
Liverpool*

\$20.87

It will be noted that our bacon sells for less than Wiltshires and hams. The Danish Wiltshires apparently are the most desirable pork imported in quantities. Consequently import quotas have favored this product.

Danish Hog Production

Normally about 80 per cent of Denmark's total slaughter of hogs is exported in the form of bacon, and in some years nearly all of the pork exports are shipped to England. The hog industry expanded with dairy production. Hogs were increased in Denmark with the introduction of the cream separator to make use of the skim milk. The principal concentrate feed is barley; however some corn, oats, rye, and wheat, especially when it is of low grade, are used. Milk by-products are used in quantities. Indoor feeding in well-constructed permanent buildings prevails as pasture and roughage are used mainly for cattle.

The hog production in Denmark was developed to supply the British market with bacon. For a time exports to Germany caused a fat type of hog to be developed, but as this trade was frequently restricted, the Danes concentrated upon a lean bacon type that would suit the English. Since 1895, England has taken the bulk of Denmark's surplus hog production. When import quotas on pork were imposed by England more than 60 per cent was allotted to the Danes.

Two breeds have been used: the domestic breed, the Danish Landrace, and the bacon breed imported from England, the

¹ *Agricultural Statistics 1940*, U.S.D.A., p. 387.

Large White or Yorkshire. The cross between these two breeds was found to be the most acceptable for producing the type of bacon desired on the English market. More recently the Landrace tended to overshadow the Yorkshire as the bacon qualities of the Landrace have been greatly improved.

Bacon Hog Raising in the United States

The northern states, including Wisconsin, Minnesota, Montana, North Dakota, and South Dakota, are in the best position to supply this type of hog. In the corn belt, where corn predominates in the swine ration, bacon hogs tend to become too lardy for best Wiltshires.

Although we apparently can grow bacon hogs and produce Wiltshires, this has never developed into a large business. American meat packers have not been successful in meeting the competition from European Wiltshires on the English market. The American-made Wiltshire sides are generally criticized for excessive saltiness by the English.

Feeding Hogs for Wiltshires

In U. S. Department of Agriculture investigations¹ it was found that in contrast to the intensive European methods of swine production, self-feeding simple rations on alfalfa pasture in large groups produced a large proportion of suitable Wiltshire sides. Yorkshires, Chester Whites and their crosses, and a few Duroc Jerseys were used in this series of experiments. A few of the carcasses were overly fat for export bacon but were highly satisfactory for domestic consumption. Wheat and barley were the grain components of the ration; tankage and minerals, and alfalfa pasture supplemented the grain.

Pork Export Cuts

In addition to Wiltshire sides, we also export Cumberland sides, and regular long clears, which are cut differently from our regular pork cuts. Briefly described they are as follows: Cumberland sides include the side and shoulder in one piece, cut square on the ham end and leg cut off below knee joint;

¹ R. E. Hutton and E. Z. Russell, "Production of Hogs Suitable for Wiltshire Sides," *Circ.* 532, U.S.D.A., November 1939.

regular long clears comprise the side of a carcass with the ham off and the backbone, shoulder bones, and ribs out, fore leg cut off close to the breast, and the aitch and breast bones cut down smooth with the face of the side.

There are other less well-known export cuts which from time to time enter into the export trade.

Our export trade is not limited to the so-called export cuts. Considerable quantities of hams and lard are also sold abroad at times.



FIG. 143. A champion Yorkshire boar.

Description of the Bacon Type

As compared with our common hogs, the so-called bacon hog is not so wide, somewhat longer, deeper in the side, smoother at the shoulder, somewhat longer in the head, neck, and legs, and less plump in the ham. Even when finished, the bacon hog is less fat or wide than our intermediate hog of the meat type. The bacon hog is more muscular and less lardy than our usual top market hog. In temperament the bacon hog is less lymphatic and more active and animated.

The description of an ideal bacon type pig that would satisfy the market requirements as previously set forth would also depict, within limits, the ideal breeding gilt and boar. The

ideal individual for breeding is of course one that will produce the kind which will yield the Wiltshires in demand on the critical and discriminating English market. This does not imply that the producing of suitable products is merely a matter of breeding, since feeding and processing are also important.

Since the same general type is applicable both to the market hogs and those for the breeding herd, a short description follows. It should be pointed out, however, that many characteristics are given emphasis in the breeding herd which are disregarded in the market hog.

In size the bacon hog should be well developed for its age. The market weight limits are rather narrow: 140 to 170 pounds for grade A class carcasses. Size for age to secure rapid and economical gain, and reasonably early maturity are emphasized.

The form of the bacon hog is typical. Briefly, a form that is long and in which all parts are proportionately developed so as to have a well-balanced, strongly built individual is perfection. The top line is slightly arched and carried strong, and the side lines and under lines are straight. Trimness and neatness are essential.

The quality is indicated by fine hair and smooth skin which shows no tendency to wrinkle. Clean strong bone, rather refined, also denotes quality. In individuals of high quality, the flesh is firm and smooth with no flabbiness at the jowl, fore-flank, belly, or ham.

Condition. In general, bacon hogs have less finish than our common market hogs. A good covering of firm flesh especially along the back and loin is needed, but overfatness is to be avoided.

Style. Canadian score cards for bacon hogs include style, under which they specify that the ideal should be active and sprightly, walking without a swaying movement, and standing well up on the toes. Breeding animals should show strong character.

The head will vary a great deal with the breed. Within the Yorkshire breed, which is the predominating bacon breed of Canada, much variation exists. Moderate length and width of head are desired. A face that is broad between the eyes and at the poll is required. Good size, bright eyes, moderately fine ears

are specified. A jowl that is of fair width, muscular, neat, and not flabby, and a neck that is muscular and of medium length are emphasized.

In the fore quarters, the shoulder is the most important single part. It is to be smooth, somewhat rounded from side to side over the top, very compact, no wider than the back, and not extending back on to the side. The breast and chest should be wide, deep, and full.

The body is made up of several very important parts; back and loin of moderate width, rising slightly above a straight line, but not unduly arched, are wanted. Weak, sagging backs are discriminated against. A uniform width and fleshing with a slight arch is the description of the proper back and loin. The side that is deep, long, smooth, well fleshed, and straight between the shoulder and ham meets the requirement of the Wiltshire. Ribs of good length, moderately arched, are essential for a good side which should be the same width as the shoulders and hams throughout. Fullness at the fore and rear flank is needed for a deep side.

The hind quarter on the usual United States market hog carcass is mainly ham, but on the bacon carcass, it is the gammon, which is further divided into two parts. On the live hog these are the rump and the ham. A desirable rump is the same width as the back; long and slightly rounded from a point above the hip to the tail and somewhat rounded from side to side over the top. A ham that is full without flabbiness, somewhat tapering to the back but carrying flesh well down toward the hock, and without wrinkles or folds, is desired.

The front and hind legs should be well placed so the individual stands squarely upon them. They should be medium in length, straight, and with pasterns upright. Bone that is clean and strong and feet that are medium size and strongly formed are essential.

The Live Hog and the Carcass

Since in countries such as Canada and Denmark, which produce bacon for export, the grading is done on the carcass rather than on foot, the appraisal of the market pig on foot is of less importance than it was formerly. Instead of condition of the live

hog on foot being estimated, under the carcass grade system, the fat covering can be measured.

Selection of the breeding individual, however, continues to be a consideration of importance in the production of bacon hogs. Live hog grading has the advantage of setting before the producer the on-foot specifications for a desirable market hog. The characteristics specified will guide him in the selection of breeding hogs.

Chapter 24

HOG MARKETS

Hogs are marketed by the same methods as cattle. However, hog men usually have more market outlets than are available for cattle and there has been a greater increase in direct marketing of hogs than of other livestock. As compared with cattle and sheep, there are relatively few hogs which are taken out from the market for further feeding.

Decentralization has been more marked in hog slaughter than with other livestock. A relatively smaller amount of the hog slaughter is being done at the public stockyard centers as there has been a big growth of slaughter at the interior packing plants. Also there has been a great increase in the number of hogs trucked to market.

These changes have caused marked alterations in our hog markets and methods of marketing, and it is quite apparent that one of the characteristics of our marketing system is its changeableness. Hogs, like other livestock, may pass through several hands before they finally reach the slaughterers or these various agencies may not be used and the sale made by the producer to the packer. There are such well established agencies as farmer cooperative associations, community auction, country dealers, assembly points, or concentration yards, and public markets through which livestock may pass en route from the producer to the slaughterer.

Methods of Marketing

A raiser of hogs may sell to a local buyer, concentration yards, local auction, or local packer, any of which by definition represents a direct sale. He may also ship to a public stockyard market and use the services of a livestock commission agent who in turn would sell to a packer, shipper, or trader. For purposes of selling, the producer may join with a cooperative which would

sell to any of the buying agencies or consign to a centralized cooperative commission association. There is also some home slaughter and selling direct of the pork products.

An investigation of the 170,756 A.A.A. hog compliance forms for Iowa in 1933¹ indicated that slaughter hogs were sold through the different channels in the following proportions:

	<i>Per Cent</i>
Local buyers	47.9
Private commission firms	16.7
Cooperative shipping associations	11.1
Packer direct	11.0
Packer concentration points	5.5
Farmers	4.1
All others	2.3
Cooperative commission firms	1.4
Local auctions and local butcher	small fraction

Since this survey, the number sold through local auctions has greatly increased while the other channels of disposition have probably not changed materially. It should be pointed out that this is the first sale, and those going to local buyers will pass through several hands and through different types of organizations before they finally reach the slaughter pens.

There has been a great growth of direct marketing or sale to slaughterers at places other than recognized public stockyard markets where the owner is represented by a commission agent. In 1923, about 26.5 per cent of the total federally inspected slaughter was purchased direct, while in 1933 it was about 47 per cent. For the ten-year period 1930-1939, about 53 per cent of the hogs slaughtered under federal inspection were purchased on the public stockyard markets, and the balance were secured from other sources. During that decade, the percentage of hogs purchased for slaughter from sources other than public stockyards increased 12 per cent. The livestock purchased direct are shown in Figure 144.

According to a federal study,² the principal reasons for the rapid increase in direct marketing of hogs in recent years may be found in the competitive situation as between local or interior

¹ Geoffrey Shepherd and Norman V. Strand, "Local Hog Marketing Practices in Iowa," *Research Bull.* 262, Iowa Agr. Exp. Sta., August 1939.

² "The Direct Marketing of Hogs," *Misc. Pub.* 222, U.S.D.A., 1935.

packers on the one hand and public market packers on the other, associated with the expansion of corn and hog production in the western corn belt. The chief reasons for this competitive situation are found in the transportation developments, both rail and motor truck, as they affect convenience and cost of moving livestock direct and through public markets and of transporting live animals as compared with livestock products; in comparative labor costs among packers in different areas; in differences between direct and public market channels with respect to costs

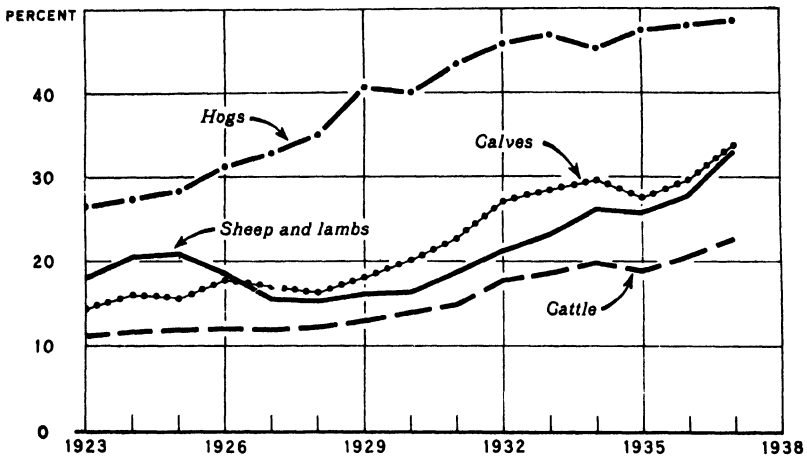


FIG. 144. Percentage of livestock purchased direct. Direct marketing of hogs began to increase just after the first World War and has continued to expand. The direct marketing of other livestock has also increased. (U.S.D.A., Bur. of Agri. Economics.)

of marketing including shrinkage, commission charges, yardage fees, and other marketing costs; and in producer preferences, which play a part in the farmer's choice of market outlet.

From this study it was concluded that the causes of increased direct marketing of hogs and other livestock are closely associated with the economic development of the country and particularly of its livestock industry. It is shown that the sharp decline in the level of hog prices since 1926 has been due to the drastic reduction in consumers' income incident to the depression and the decline in foreign demand for American hog products.'

It does not appear that direct marketing has restricted competition among slaughterers and distributors and enabled them to exact a wider margin. In fact, the principal widening in margins occurred prior to the years of rapid increase in direct marketing and was not confined to hogs or to meat animals generally, but appeared also with respect to other products outside the influence of direct marketing of livestock. The conclusion that direct marketing has not caused a widening of the margins between the price of a given weight of live hogs and the wholesale or the retail price of the products derived therefrom is also supported by the fact that these margins declined materially during recent years of rapid increase in direct marketing. This decline, however, was due largely to reductions in labor charges and some other costs during the depression.

Data on price differentials among markets show that no one market, and no particular type of market, sets the level of hog prices. The distribution of the volume of hogs consigned to public markets among the different grade classifications was shown to be approximately the same as of the hogs marketed direct; that is, the public markets on the whole were not receiving more than their proportionate share of low-grade hogs. This, together with the fact that no one market or group of markets sets the price for all markets, leads to the conclusion that the growth of direct marketing has not impaired the price-registering function of the public markets or caused the prices at the interior markets to be lower than if direct marketing had not increased.

Moreover, this study shows that the growth of direct marketing has not caused the returns to producers of hogs to be less than they otherwise would have been. This was contrary to the opinions of some who were interested in the quest.

Although this study shows that the growth of direct marketing has not been to the disadvantage of the producer, it also shows that there is need for correction of some practices and the development of additional services to improve the marketing of hogs.

In the disposition of hogs, this investigation made in 1932 and 1933 indicated farmers used the following market outlets in the proportion given.

	<i>Per Cent</i>
Public stockyards	45
Local buyers	22
Local packers	14
Cooperative shipping associations	11
Concentration yards and buying stations	6
Auctions	nearly 3

Direct Marketing in Different Areas¹

The development of the interior packing plant caused a great increase in the direct marketing of hogs, mainly in the northwestern corn belt in the states of Iowa, Minnesota, North Dakota, South Dakota, and Nebraska. However, it was not until the large packers, whose principal plants are located at or near the public stockyards, began to purchase quantities of hogs direct that direct marketing became a controversial matter. To meet the competition for hogs, the large packers secured packing plants and built concentration yards in the hog producing areas. Direct buying in hogs therefore is the greatest in the north central states.

Following is a tabulation of the percentage of hogs purchased direct by packers in various regions in 1938:

	<i>Per Cent of Hogs Purchased Direct</i>
North Atlantic states	32.3
South Atlantic states	66.0
North central states (eastern)	37.4
North central states (northwestern)	73.5
North central states (southwestern)	52.7
South central states	36.9
Mountain states	55.9
Pacific states	73.1
United States	51.7

The large packers have greatly increased their direct buying of hogs. For example, the Four National Packers increased the percentage purchased direct from 20 per cent in 1923 to 51 per cent in 1937. Other packers increased direct purchases during that period as well. For this group it was 32 per cent in 1923 and 46 per cent in 1937.

¹ Knute Bjorka, *Direct Buying of Slaughter Livestock by Regions, 1923-1937* U.S.D.A., 1939.

Recommendations on Direct Marketing

In the critical investigation of direct marketing made by the federal government, several recommendations were made. These, if carried out, would tend to overcome danger in this marketing system. Actually in direct marketing we have decentralization of buying or a scattered market. As a consequence, the seller may not be so well informed as to values as the buyer. A farmer, acting as his own seller, may be at a distinct disadvantage if he is not in touch with the current market situation. Several of the recommendations are directed at creating better informed sellers, while others deal with such market practices as board and add prices, filling before selling, docking piggy sows and stags, sale facilities, and weighing. These latter practices are often confusing to the seller, and the suggestions bear upon improvements that would assure the seller that his interests are protected.

The statement of the recommendations follows.¹

1. The method of pricing hogs in vogue at certain direct buying points in some areas by means of a "board" price which is posted and made generally known, together with a variable "add" to this price, which is not publicly announced, leads to confusion and uncertainty regarding the price situation and may readily be developed into a deceptive or discriminatory practice. This method should be modified or replaced by one that makes generally known to all sellers the range of prices that are being offered and being paid for different grades of hogs.

2. The practice of "filling" hogs by feeding before selling should be discontinued at all markets, except such feeding as may be advisable for humanitarian reasons. The practice is wasteful of feed, increases marketing costs, reduces the value of the animals for slaughter, and tends to lower rather than to increase total net returns to producers.

3. The practice of docking "piggy" sows and stags to partially offset their undesirable characteristics as slaughter animals is not an equitable method of accomplishing this end, and the

¹"The Direct Marketing of Hogs," *Misc. Pub.* 222, B.A.E., U.S.D.A., March 1935.

practice should be eliminated in all markets. Such animals should be sold and bought on their merits at actual weights, as is now done in the case of cattle and sheep.

4. Scale facilities and weighing by the buyers of hogs at interior marketing points should be subject to such supervision as will give general confidence that sellers' interests are fully protected.

The above-recommended actions and the correction of any other undesirable practices might be effectuated in part by mutual agreements or common consent among buyers and sellers and/or by such further enlargement of the powers and facilities of the Packers and Stockyards Administration as may be needed to give this agency the necessary authority to accomplish these ends.

5. It is further recommended that uniform grade standards for trading in hogs be adopted for use at all types of markets. This would facilitate the sale of hogs on the basis of quality and would eliminate the confusion arising from the use of many systems of grading and of grade terms that differ from market to market. Since the adoption of standard grades for hogs and their application (sorting and selling by grades) through voluntary agreement is unlikely, and the grading of hogs by official graders under mandatory requirements would entail considerable addition to marketing costs, an intermediate plan is suggested. Selling and buying on grades would not be compulsory, but if trading is done on the basis of grades, Federal standards alone would be used under Federal supervision, and all price quotations on grades should be in terms of these Federal standards. This would require additional legislative authority.

6. Extension of the Federal Market News Service is suggested. The service now maintained in the Iowa and southern Minnesota direct-marketing area should be strengthened, and a similar service is particularly needed in other important direct-marketing areas, especially in the eastern Corn Belt, where information regarding supply, demand, and prices paid is at present quite inadequate to allow producers to choose the best outlets available. The general adoption of uniform grades would provide a better basis for quoting and reporting prices of hogs.

Leading Hog Markets

The large hog markets are located in or near the corn belt, the area of our densest hog population. The pork packing plants have tended to move toward the areas of hog raising, and local or interior packers have increased their slaughter. In this decentralization, the packers at the central markets have established buying points in the producing areas. The hogs moving direct are a part of the receipts on the markets, but it is obvious that the central markets secure a smaller proportion of the total hogs marketed than formerly.

Chicago is still the leading hog market of the country in numbers. For the decade 1930-1939, the receipts yearly have averaged over 5 million head, more than twice the number at the next largest market. The markets are continually changing in rank as receipts fluctuate markedly. National Stockyards, Illinois, or East St. Louis, Omaha, South St. Paul, Indianapolis, and Sioux City are very large central hog markets. A listing of large hog markets based upon a recent ten-year period follows. This list does not include Indianapolis or some other large hog markets such as Cincinnati, New York, and Baltimore. Rather it is based on markets with large receipts of all kinds of livestock.

HOGS — TOTAL RECEIPTS AT PUBLIC STOCKYARDS,
1930-1939 AVERAGE ¹

	<i>Thousands</i>
Chicago	5,710
National Stockyards, Illinois	2,715
Omaha	2,258
South St. Paul	2,198
Sioux City	1,657
South St. Joseph	1,088
Kansas City	1,063
Denver	505
Forth Worth	330
Total nine markets	17,525
All others reporting	13,559
Total reporting	31,084

Seasonal Variation in Hog Receipts

Since farrowings are peaked in the spring and fall, it is obvious that marketings would be the heaviest when the crops are ready

¹ U.S.D.A., *Agricultural Statistics*, 1940, p. 372.

for market. Some farmers full feed, making possible a finished market pig at six months of age, or slightly under, while others follow a limited feeding plan for a longer time. Circumstances may alter the time of marketing and desirable marketable weights.

Peaks in market receipts of hogs occur in the late fall when the spring pigs predominate in the receipts. There is another slight peak in May and June from the marketing of fall-farrowed pigs. Since feeder and stocker pigs are but a small fraction of the receipts, hog slaughter follows market receipts very closely.

Following is a tabulation of the receipts of hogs by months for a recent ten-year period.

TOTAL RECEIPTS BY MONTHS AT PUBLIC
STOCKYARD MARKETS; AVERAGE FOR
TEN YEARS, 1930-1939

<i>Month</i>	<i>Yearly Average, Thousand Head</i>
January	3,427
February	2,623
March	2,454
April	2,404
May	2,464
June	2,320
July	2,090
August	2,157
September	2,519
October	2,581
November	2,899
December	3,148
Total	31,084

The months of January, December, November, and February are those of very heavy receipts. These too are months of comparatively low prices. Months with low receipts like August and September are generally those in which the hog prices are relatively high. The seasonal variation is due then to the natural movement of the finished pigs to the market. Spring pigs, more numerous than fall pigs, are marketed from late August on and reach the peak of movement in December or January. Marketings then decline until April and May when fall pigs appear in number on the markets. Low receipts prevail in the summer because of the absence of a crop of pigs.

The receipts as a consequence are made up of a relatively large proportion of packing sows.

In the northern section of the corn belt marketings are more seasonal and the winter movement is more pronounced than in the southern corn belt, where the two litter a year plan is more extensively followed.

Seasonal Variation in Hog Weights

Heavy hogs predominate on the markets in the summer and early fall. It is not unusual for one-third of the receipts during August to be packing sows. The average weight is less when the younger hogs make up the largest proportion of the receipts.

The average weight of hogs and pigs by months on the Chicago market follows.

HOGS — AVERAGE LIVE WEIGHT AT CHICAGO,
1930-1939 AVERAGE¹

<i>Month</i>	<i>Average, Pounds</i>
October	235
November	227
December	229
January	236
February	239
March	246
April	246
Weighted average — October to April	236
May	246
June	255
July	266
August	270
September	256
Weighted average — May to September	267

Feeder Pig Markets

Actually a comparatively small number of feeder pigs pass through the central market. Such pigs are usually moved direct from the grower to the feeder or are marketed through local buyers, auction sales, and truckers. The greatest movement of

¹ U.S.D.A. Agricultural Statistics, 1940, p. 373. It will be observed that the above is divided upon the basis of the hog marketing year, which begins in October. Light hogs are more numerous as the season's crop is marketed, with November having the lowest average weight. Packing sows account for heaviest average weight in August.

feeder pigs is in September and February, but it is spread quite uniformly in the other months.

Of the central stockyards, South St. Paul, Sioux City, Kansas City, and East St. Louis have fairly large receipts. Memphis, Wichita, Omaha, Springfield (Missouri), Oklahoma City, and St. Joseph also have numbers of feeder pigs offered for sale. The above order is the rank in number of receipts of feeder pigs for a recent period. The feeder pig trade is quite variable from



FIG. 145. A movable loading chute. A loading chute such as this with a cleated floor is a safeguard against injuries in loading. (Harry J. Boyts, National Loss Prevention Board.)

year to year. It is markedly affected by the pig crop in an area and available feed supplies.

The trade in feeder and stocker pigs is comparatively small, as indicated by the total receipts at 67 markets of less than 500,000 head a year.

Shrinkage of Hogs in Shipping

There is a normal loss of weight, called "shrinkage," from the time of weighing at the point of origin to the time of weighing after the sale on the market. As feeding is interrupted and there is an excretory loss of urine, feces, and moisture in expired air, home weights are higher than market weights. "Filling,"

or feeding and watering at the yards before selling, will recover some of the loss of weight. The weight at arrival is spoken of as the "shrunk out" weight. It will be recalled that it is recommended that hogs not be filled by feeding before selling.

Numerous investigations have been made on the subject of shrinkage in hogs being marketed, and there is much disagreement in the actual amount of weight loss or shrink.

A study made in 1921 on shipment made by cooperative shipping associations indicated the following shrink.

HOGS—PERCENTAGE OF SHRINKAGE IN SHIPMENTS BY COOPERATIVE ASSOCIATIONS, 1921¹

Distance, Miles	Shrinkage, Percentage of Weight Shipped	
	Straight Shipments*	Mixed Shipments†
Less than 100	1.48	1.91
100-150	1.10	2.23
150-200	1.25	1.91
200-250	1.24	2.76
250-300	2.10	2.89
300-350	2.11	3.47
350-400	1.80	4.00
400-450	1.71	3.62
450-500	1.62	1.94
500-550	2.13	3.60
550-600	3.07	....

* Straight shipments contain but one species of livestock.

† Mixed shipments contain more than one species of livestock.

It will be observed that shrinkage increases with distance and time of shipping, and that shrink is greater in mixed shipments (more than one kind of livestock loaded together) and with lighter hogs. Hogs shrink less than other farm animals en route to the market. There appears to be some seasonal variation in hog shrinkage, it being less in winter than at other seasons of the year.

A study of "fills" on hogs² indicated that hogs would take on

¹ Yearbook, U.S.D.A., 1922, p. 905. Shrinkage represents the difference between the shipping-point weight and the terminal weight, including the weight of all crippled and dead. Hence the shrinkage figure is over and above the direct losses due to crippled and dead.

² Armour's Livestock Bureau, *Monthly Letter to Animal Husbandmen*, Vol. 10, No. 4, July 1929.

about 5.5 pounds of fill or 2.5 per cent of their live weight. Of this fill 65 per cent was corn and 35 per cent water.

Transportation to the Market

A larger proportion of hogs are transported by motor truck than any other class of livestock. Only 2 per cent of the total receipts on 17 markets in 1916 were trucked in. In 1940 about 75 per cent of the hog receipts at these same markets were "drive ins."¹ At 65 markets the percentage of trucked hogs was 68 per cent for 1940.



FIG. 146. Hogs in the stockyards. Note the variation of the hogs in the first pen.

For hauls to market under 100 miles the costs for trucking are usually less than for rail shipments. On long hauls, rail shipping may be advantageous. Farmers generally prefer trucks, especially for shorter hauls, for several reasons. First, less time is needed to get hogs to the market, which usually is a big advantage. Second, smaller loads are taken, which gives greater adaptability. Hogs can be topped out and marketed as finished. Third, more market outlets are available by the use of trucks. Fourth, shrinkage, crippling, and death losses are no greater than in comparable rail shipments. Fifth, the truck picks up the hogs at the farm, while in rail shipment it is necessary to get the hogs to the local stockyards.

¹ *Drive-in Receipts of Livestock.* U.S.D.A., 1941.

Number of Hogs per Railroad Car

The number of hogs which are commonly shipped per railroad car is dependent upon the size of the car and the weight of the hogs. Hogs may be shipped in double-deck cars, and in loading fewer hogs are put in the upper deck, especially during warm weather. Overloading and underloading are to be avoided since these are contributing factors to injury and death. There follows a statement of the average number of hogs which should be shipped in cars of the two common lengths.

HOGS PER RAILROAD CAR PER DECK¹

Car Size	Average Live Weight											
	100	125	150	175	200	225	250	275	300	325	350	400
36-ft.	130	115	100	89	79	73	68	62	59	56	53	47
40-ft.	140	127	110	98	88	82	76	69	65	62	59	52

Shipping Losses

The National Livestock Loss Prevention Board investigation indicates the following ratio of death and crippling among hogs received at the markets.

PERCENTAGE OF LIVESTOCK RECEIPTS DEAD AND CRIPPLED
ON ARRIVAL BY RAIL AND TRUCK AT KANSAS CITY,
ST. JOSEPH, OMAHA, SIOUX CITY, AND ST. PAUL

Five-Year Average, 1935-1939

Hogs — Per Cent Dead		Per Cent Crippled	
Rail	Truck	Rail	Truck
0.060	0.093	0.229	0.220

The death loss is higher for trucked hogs than for those shipped by rail, partly because some disabled hogs are shipped by truck that could not be shipped by rail. Poor loading conditions and improper handling are no doubt more prevalent in truck than in rail shipments. The losses are quite tangible. Other damage such as bruises are evident only upon slaughter.

¹ Swift and Co., *Bull.* 20, May 1941.

Practices Recommended in Shipping Hogs

By following certain shipping practices, it is possible to reduce death and crippled losses in shipping hogs to market. Based on a study of shipping hogs to market, Wiley¹ has made the recommendations given below.

1. Not feeding hogs in cars during warm and hot weather, or when the maximum temperature during transit is 60 degrees or higher.

2. Cleaning cars before loading, particularly during warm and hot weather, or from April to October, inclusive, for the corn belt shipping territory.

3. Bedding cars with sand during cool, warm, and hot weather (40 degree maximum temperature and above), and with straw or sand and straw during cold weather.

4. Showering hogs during warm and hot weather when the cars are bedded with sand.

5. Loading a 36-foot single-deck car less than 18,000 pounds during cold and cool weather and less than 17,000 pounds during warm and hot weather. (Under 20,000 pounds for a 40-foot single-deck car during cold and cool weather and under 19,000 pounds during warm and hot weather.)

6. Partitioning large hogs like sows and stags away from smaller hogs, especially when they are not accustomed to running together.

¹ James R. Wiley, "Death and Crippled Losses in Shipping Hogs to Market," *Bull.* 318, Purdue Univ. Agr. Exp. Sta., 1927.

Chapter 25

MARKET CLASSIFICATION OF HOGS AND HOG PRICES

In this chapter there are two divisions, the first dealing with the classes of hogs on the market and the second with prices of market hogs. The discussion of price pertains only to market hogs, which are mainly for slaughter and feeding. Breeding hog prices are excluded.

MARKET CLASSIFICATION OF HOGS

The hogs on the market present a wide range in weight, form, finish, and quality. On our early markets, a one-price system was used and hogs of all kinds were sold for the same price per pound. As consumer preferences became manifest, differentiation in various hogs became prevalent. The factors related to the desirability of a hog from a consumer standpoint were weight, sex condition, conformation, finish, and quality.

Hogs are sorted into various lots based upon characters that affect carcass value. Such sorting permits transactions in groups or lots quite similar in all essential respects. The general process of dividing swine into classes, subclasses, and weights is termed "classifying." The term "grading" applies to the last step in the sorting process and results in rather uniform groups or lots which are offered for sale.

Different Market Classifications

A great variation exists in the market classification for hogs and in the nomenclature used to designate their classes, weights, and grades. In the direct marketing investigation by the U. S. Department of Agriculture previously referred to the 204 different market outlets of the various types used 72 different classifications. A breakup of the market outlets indicates the following.

20 public markets used 10 different classifications.

55 public market packers, and interior packers used 25 different classifications.

90 concentration yards and assembly points used 26 different classifications.

39 auction markets used 26 different classifications. The livestock trade papers at public markets also use wide variety of terms descriptive of the weights, classes, and grades of hogs.

In the discussion that follows the standard classification of the Agricultural Marketing Service is used as the basis. The classification for barrows and gilts was agreed upon by representatives of packers, producers, and Department of Agriculture in 1931.

Benefits of Classifying and Grading

It is quite apparent from the many classifications in use that uniform or standard classification would be of great value to all concerned in hog production and marketing. The most self-evident benefits which are listed in the U. S. Department of Agriculture circular on "Market Classes and Grades of Swine"¹ are: (1) It enables the purchaser to buy animals of the particular class, weight, and grade he wants, without buying some of a class, weight, and grade that he cannot advantageously use. (2) It makes possible a more accurate appraisal of value, since the value of a group of swine that are of the same class, weight, and grade can be estimated more accurately than can the value of a group that vary more or less with respect to class, weight, and grade. Thus, trading is simplified and buyers and sellers trade on a basis that more nearly reflects the current market value of a particular class, weight, and grade of swine than otherwise would be possible. (3) It provides a basis for more accurate and useful market reports whereby patrons of the market are kept informed regarding current market prices of the different grades, classes, and weights of swine. (4) It provides a basis for comparable statistical data very useful to market analysts and others engaged in studying the cyclical and seasonal movements of production, marketing, and prices as they relate to swine of the various grades, weights, and classes.

¹ Don J. Slater, "Market Classes and Grades of Swine," *Circ. 659*, U.S.D.A., 1941.

(5) It serves as a guide to the producer in planning his production and marketing program by keeping him informed as to the relative demand for hogs of various grades and weights. (6) It enables sellers and buyers of hogs to make an accurate comparison of prices at different points and thus tends to promote more orderly marketing. (7) It facilitates the purchase of hogs through order buyers by packers whose plants are not located adjacent to a source of supply.

Market Classes and Grades of Swine

A study of a rather complete report of the hog market will indicate groupings by sex, use, weight, and also grades. No attempt is made to bring age into the classification directly as in the case of cattle, as a weight division effects the same purpose when combined with sex. Market hogs are mainly for slaughter, though a few are sold as feeders and rarely a few are disposed of for breeding. Following is a tabulation of the market classes and grades of swine¹ which may be on the market.

MARKET CLASSES AND GRADES OF HOGS

	<i>Basis for Grouping</i>			
	<i>Sex Classes</i>	<i>Use Selection</i>	<i>Weight Division</i>	<i>Grades</i>
Divisions in each group	Barrows and Gilts Sows Stags Boars Pigs	Slaughter Feeder and Stocker	Different in Various Classes	Choice Fat Type Choice Meat Type Good Medium Cull

In comparing the schedule with that used for cattle, it will be observed that there is one less use selection and one less grade as well as no age division. Also there is, in the swine, a classification breakup of the choice grade in "barrows and gilts" and

¹ "Swine" is used to designate both hogs and pigs. Hogs weigh 120 pounds and over, and may be of either sex or unsexed. If sexed, a hog has attained sufficient age or maturity to make reproduction possible. Pigs are under 120 pounds, either sex or unsexed, with insufficient age or maturity to make reproduction possible. *Circ. 659*, U.S.D.A. On the Chicago market "pigs" are swine weighing 130 pounds or less. Actually in the trade, the term "hogs" is used to cover all swine.

sows into fat type and meat type. As indicated previously, this is a market use of the term "type," and it is irrespective of lard and bacon or small and large type. In market usage this division is upon the proportion of fat to lean and yield of the different primal cuts. The fat type have a higher proportion of fat to lean, especially in the bacon bellies and regular hams, as indicated previously. See Chapter 26 for a comparison of the yields of these two types.

Market Classes or Sex Classes of Swine

As previously indicated, a market class includes individuals of the same sex condition. Five classes of swine are recognized, "barrows and gilts," sows, stags, boars, and pigs. The sex condition is related to certain physical characteristics which influence conformation, finish, and quality. Because of these differences and the fact that they are related to the carcass and its use, we have division or group. A description of each class follows.¹

BARROWS

A barrow is a castrated male hog that shows no pronounced indications of sex development similar to those in an uncastrated male. As a rule the animal is castrated when only a few weeks old.

The animal usually has developed physical characteristics that are peculiar to its class. As a class, barrows are more evenly developed and balanced in conformation than stags, sows, and boars. The natural fleshing or muscular development of the various parts such as neck, shoulders, loins, and hams is more evenly developed and balanced. The difference between barrows and gilts in these respects, however, is very slight.

GILTS

A gilt is a young female hog that has not produced pigs and that has not reached an evident stage of pregnancy.

The animal has usually developed physical characteristics that are peculiar to its class. Gilts are very nearly the equal of barrows so far as being evenly developed and balanced in muscular development and conformation is concerned, although they

¹ U.S.D.A. *Circ.* 569.

tend, as a class, to be slightly lighter and less developed through the shoulders than barrows of corresponding weight and grade. The bacon sides from gilts usually require more trimming on the belly side than the bacon from barrows, because of the more pronounced so-called "seeds," thus slightly reducing the percentage of bacon bellies which ordinarily rank high in relative market value. Furthermore, a varying percentage of gilts when marketed usually have reached a stage of pregnancy which materially reduces their dressing percentage or carcass yield. Although this condition may not be detected in the live animal, it does cause a slight price discrimination against gilts on the part of practically all packer buyers and may in time result in barrows and gilts selling as distinctly separate market classes.

SOWS

A sow is a female swine that shows evidence of having produced pigs or that is in an evident stage of pregnancy.

Sows, as a class, are somewhat unevenly developed and lack balance in their muscular development and conformation. As a rule, they become relatively lighter in the shoulder and narrower through the fore part of the body as they increase in age and weight. Almost without exception the bacon sides from sows require more trimming on the belly side than do the bacon sides from barrows and gilts. Furthermore, as noted in the case of gilts, a considerable number of sows have reached a stage of pregnancy when marketed which, although not noticeable in the live animal, materially reduces the dressing percentage. Sows, as a class, carry a larger proportion of fat than the corresponding grades of the other classes of slaughter hogs. Usually the fat covering is also somewhat thicker than that of other classes of slaughter hogs.

STAGS

A stag is a castrated male swine that shows pronounced sex development or physical characteristics peculiar to the adult uncastrated male.

Stags, as a class, are unevenly developed and lack balance in their muscular development and conformation. As a rule the neck and shoulders are overdeveloped and heavy, as related to

other parts of the animal. As a class stags have relatively thick skins, coarse hair, and large bones and are rough and heavy at the joints. They are not marketed in sufficient numbers to make the buying and selling of animals of this class on the basis of grade either practical or desirable. Hence grade descriptions for the different grades of stags, although possible and logical, theoretically at least, are commonly omitted. As a general rule stags are subject to a dockage of 70 pounds at terminal markets which usually results in the lighter weight stags selling at higher prices than the heavier weight stags of like conformation, finish, and quality or grade. When marketed "direct," stags usually are not subject to dockage in weight but are sold at a price that reflects the weight and the grade or degree of conformation, finish, and quality of the individual animal.

BOARS

A boar is an uncastrated male swine. Boars, as a class, show a greater development of masculine characteristics than do the class termed "stags."

Compared with other parts of the body, the neck, shoulders, and bones of boars are overdeveloped, causing the general conformation of the animal to be uneven and its various parts to lack balance in like degree. As a class they have less thickness of fat covering than other classes of hogs, and sex condition does not affect the distribution or uniform thickness of fat covering to any noticeable extent. They are very thick skinned, coarse haired, and heavy boned. As a class, they are the least desirable of all swine from a market standpoint. Boars, particularly those that have attained sufficient weight to be termed "hogs," should never be sent to market as such but should be castrated and fed a month or longer before marketing. The market value of boars as slaughter animals is necessarily low since a considerable percentage are condemned, because of odor, as unfit for human consumption.

BARROWS AND GILTS ONE MARKET CLASS

Barrows and gilts of the same weight that are typical of any given grade have practically the same conformation, finish, and

quality because the sex condition in these two classes does not materially affect the characteristics on which the grade is based.

Hence in actual market practice barrows and gilts of the same weight selection and of the same grade almost invariably sell together, being for all practical purposes one market class, and are so recognized by practically all members of the trade. The relative number of barrows and gilts in any specific lot, however, does affect the price of that lot to a slight extent since barrows usually yield a slightly higher percentage of carcass and a slightly higher percentage of bacon bellies on the average than do gilts of the same weight and grade.

Weight Divisions or Selections

There are numerous weight divisions of hogs, especially barrows and gilts. Sometimes the top price is paid for a rather narrow range in weight, but when heavy hogs are scarce in proportion to demand, many weight brackets are quoted at the same prices.

Hogs, the same in all respects but weight, will vary in dressing percentage, weight of carcass, size, and proportion of wholesale cuts. As the weight is increased in hogs the lard yields increase, also there is a larger amount of the fat cuts, such as bacon bellies, clear plates, and fat backs. Lean cuts such as loins, hams, shoulders, and butts make up a smaller proportion of the heavy carcass than the light carcass.

Market Grades

The market grade of a hog is determined from the excellence of conformation and the degree of finish and quality. Upon these factors we have a basis for grading which in swine consists of a division into three or four groups. Often the two top grades, choice and good, are put together. These are followed in order of goodness by the grades medium and cull.

Conformation, Finish, and Quality are the Important Factors Which Affect Market Grade

Conformation is the form, shape, outline, or contour of the hog and its different parts. It is important as a grade factor

because it influences to a considerable extent (1) the amount or percentage of carcass weight as related to the live weight of the animal, commonly referred to as "dressing percentage"; (2) the amount or percentage of the various standard wholesale cuts of pork that the carcass will produce; and (3) the percentage of lean meat, fat, bone, and skin in the standard wholesale cuts of pork obtained from the carcass.

The ideal conformation in swine indicates that the animal, when slaughtered, will have a high dressing percentage and will produce a carcass with a proportionately thick covering of flesh throughout. The highest possible percentage of total weight should be in the higher priced cuts, such as loins, Boston butts, hams, and bacon bellies.

Finish refers to the amount and the quality or character of fat. It includes both that which is on the outside of the animal's body and that on the inside of the abdominal and thoracic cavities as well as intermuscular and intramuscular fat that surrounds and permeates the muscle fiber. In the live animal the interior fats can be judged only by analogy. Finish is dependent somewhat on inherited tendencies or breeding and somewhat on sex condition and age, but it depends largely on the quantity, kind, and quality of feed consumed by the animal and on methods of handling and care.

Finish is important because it influences more than any other single factor (1) the dressing percentage of the animal, (2) the weight and percentage of the various standard wholesale cuts of meat which the carcass will produce, (3) the percentage of lean, fat, bone, and skin in the standard wholesale cuts of pork obtained from the carcass, (4) the percentage of connective tissue, intermuscular and intramuscular fat contained in the muscle or lean meat of the animal, and (5) the quality or character of all the fat.

The ideal degree of finish in swine indicates that the proper thickness and firmness of external and internal fat is smoothly and evenly distributed.

Quality, defined as a livestock grade factor, is a characteristic of the muscle or lean meat and the fat of the animal. Quality varies considerably with age and to some extent with sex condition and methods of handling and care. Quality is especially

important because it is considered to be an indication of the varying percentages and character of the connective tissue in the lean meat, the size of the muscle fiber, that is, the grain or texture of the lean meat, and the percentage of intermuscular and intramuscular fat and dry matter contained in the lean meat. Experience indicates that these characteristics influence the tenderness, palatability, juiciness, and flavor in the lean meat of the cuts of pork which the animal will produce.

Quality in the live animal is indicated by its degree of refinement, condition of hair, smoothness and thinness of skin, smoothness of the joints of the legs, and size of the bones of the legs as related to the size and weight of the animal.

Market Classification

The multiplicity of market classifications for swine has been previously pointed out. The official grade standard is the basis for the market news service reports of the U. S. Department of Agriculture. In this separation sex condition, weight, conformation, finish, and quality are considered as determinants of class and grade of slaughter swine. These factors are related to the value of a slaughter swine because of their relationship to the kind, size, quality, and yield of the wholesale pork cuts.

The grade of the slaughter hog on foot is directly correlated to the carcass grade which in turn is a reflection of the yield and grade of pork cuts.

The schedule that follows is that for slaughter hogs.

The grades are shown in Figure 147.

In a market quotation often there is a bracketing of the smaller divisions, for example, the grades good and choice are commonly handled as one and when the same price is quoted for a range in the weights the detailed breakup is not made.

Some terms that have been used for years continue in spite of their absence from the federal government schedule. For example, it is quite common to use the term "butcher hog" for a part of the federal standard class of barrows and gilts. A detailed description of the different grades is not necessary as the poor grades merely deviate from the better grades in the extent to which they fail to meet the specifications. However, the top grades set the standard and consequently the detailed

SLAUGHTER HOG SCHEDULE

<i>Classes of Hogs</i>	<i>Weight Selections, Pounds</i>	<i>Grades</i>
Barrows and Gilts	120 to 140	Choice (Meat Type) Choice (Fat Type) Good Medium Culls
	140 to 160	
	160 to 180	
	180 to 200	
	200 to 220	
	220 to 240	
	240 to 270	
	270 to 300	
	300 to 330	
	330 to 360	
	360 to 400	
	400 and up	
Packing sows	270 to 300	Choice (Fat Type) Choice (Meat Type) Good Medium Culls
	300 to 330	
	330 to 360	
	360 to 400	
	400 to 450	
	450 to 500	
	500 to 600	
	600 and up	
Stags	All weights	Ungraded
Boars	All weight divisions	Ungraded
Pigs	100 to 130	
	100 and down	

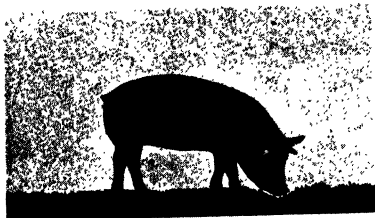
descriptions are included. In barrows and gilts we have two top grades; a description of both follows.

Choice (Fat Type) grade slaughter barrows and gilts have excellent conformation, finish, and quality. The body is relatively wide and deep and slightly short in proportion to the weight of the animal. The head is small in proportion to the weight of the animal, and the jowls are full and thick. The neck is relatively short and broad on top. The shoulders are wide, smooth, and full. The back is slightly short but is wide and full. When viewed from the rear, the back of the animal appears slightly flat on top. When viewed from the side, the back is slightly arched from poll to tail. The sides are slightly short but are smooth, deep, and thick and are approximately straight and even with shoulders and hams. The under line is approximately straight and level, and both fore and rear flanks are full and thick. The hams are wide and smooth and are full and thick both on the inside and outside, with short shanks. The animal

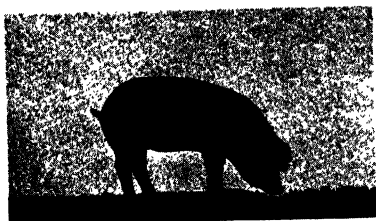
BARROWS AND GILTS



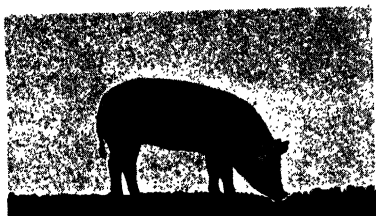
CHOICE (Fat Type)



CHOICE (Meat Type)



GOOD

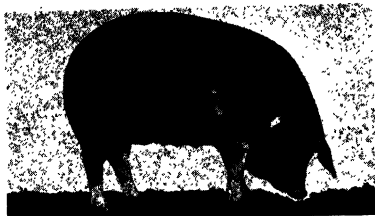


MEDIUM



CULL

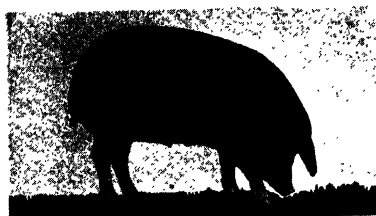
SOWS



CHOICE (Fat Type)



CHOICE (Meat Type)



GOOD



MEDIUM



CULL

FIG. 147. United States grades of slaughter swine. (U.S.D.A., Agricultural Marketing Service.)

has a thick, apparently firm, covering of fat, the lines of each part being full and well rounded. The fat covering is smooth and uniform. The hair is fine and glossy. The skin is smooth and thin. The legs are smooth and the bones of the legs are small and short in proportion to the weight of the animal. The degree of quality or refinement and the degree of finish of the animal indicate that the lean meat of the carcass will contain a relatively small percentage of connective tissue and a proportionately large percentage of intermuscular and intramuscular fat.

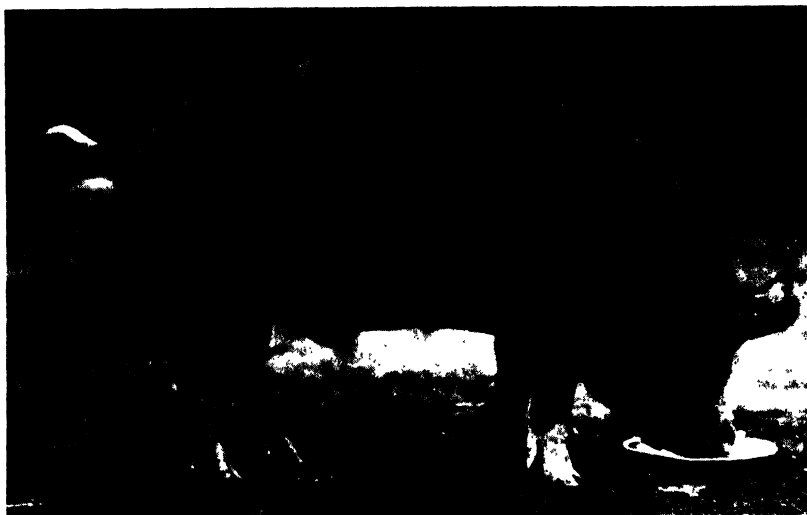


FIG. 148. Grand champion barrow over all breeds, both on foot and in the carcass, at the 1941 National Market Hog and Pork Products Show. Shown by Ivan T. Snowden, Mattoon, Ill.

Cuts of pork produced from animals of this grade are largely of Choice or No. 1 grade with respect to quality of product. In order to produce a more marketable product, however, the skin and more or less of the fat covering are removed from the shoulders and hams cut from carcasses of hogs of this grade.

Carcasses from animals of this grade usually have a relatively large percentage of bacon bellies, clear plates, fat backs, leaf fat, and fat trimmings; a proportionately small percentage of Boston butts, picnic shoulders, loins, hams, and lean trimmings, and a small percentage of neck bones, spareribs, and rough feet.

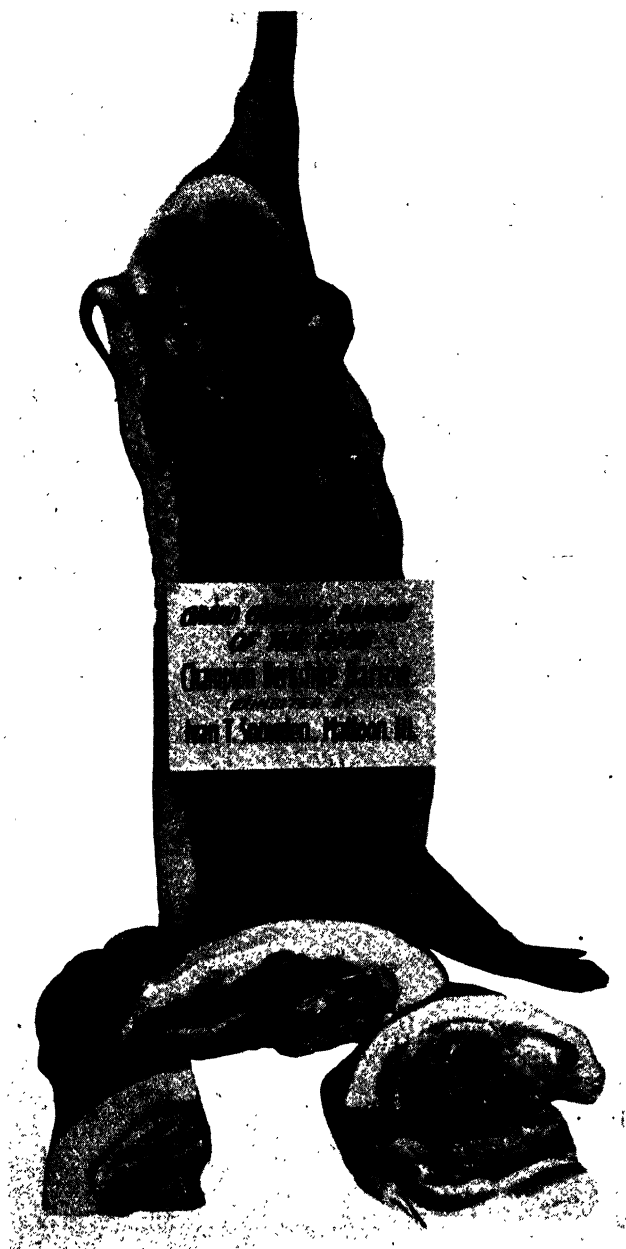


FIG. 149. A grand champion carcass from the grand champion barrow shown in Figure 148.

Hogs of this grade are usually purebred, crossbred, or relatively high-grade animals of one of the recognized breeds of swine. Usually they are of the heavier weight selections, 220 pounds and over, with relatively few of them weighing under 200 pounds. Marketings of hogs of this grade tend to increase during seasons when the price of hogs is relatively high as compared with the price of corn. When the price of hogs is relatively low compared with the price of corn the percentage of this grade included in market receipts tends to decrease.

Choice (Meat Type) grade slaughter barrows and gilts have excellent conformation and quality and a moderately high degree of finish. The body is moderately long, wide, and deep in relation to the weight of the animal. In detailed description there is not much difference between these and the previously described (fat) type. As the term implies (meat type), fatness is emphasized less than meatiness.

Cuts of pork produced from animals of this grade are generally of Choice or No. 1 grade with respect to quality of product. The hams and shoulders produced from hogs of this grade are usually marketed as regular hams and shoulders, as these cuts do not have an excessively thick covering of fat but one that is just thick enough, on the average, to ensure lean meat of Choice or No. 1 quality or grade.

Carcasses from animals of this grade usually have a moderately large percentage of bacon bellies, clear plates, fat backs, leaf fat, and fat trimmings; a moderately small percentage of Boston butts, picnic shoulders, loins, hams, and lean trimmings; and a moderately small percentage of neck bones, spareribs, and rough feet.

Hogs of this grade are usually purebred, crossbred, or relatively high-grade animals of any of the recognized breeds of swine. They usually weigh from 180 to 230 pounds, with relatively few falling within either the lighter or the heavier weight selection groups of slaughter hogs. Marketings of hogs of this grade are usually most numerous when the price of hogs is about normal as related to the price of corn, or when a near normal corn and hog ratio is in effect.

In the grades of slaughter sows the federal grade also recognized the Fat Type and the Meat Type. The main difference

is in the finish, which is only moderate in the meat type while fat type sows are well finished.

In normal years, sows other than gilts will constitute about 12 per cent of the total receipts. Within a year more than 30 per cent of the packer and shipper purchases in August will be packing sows, while in the first four months of the year the percentage will usually be under 4 per cent.

Slaughter Pigs

Swine under 120 pounds are classed as pigs on the market. Since their weights would permit their sale as feeder and stocker pigs, they are slaughtered only when the demand exceeds that for feeders. There are two market classes of slaughter pigs; (1) boars, (2) barrows and gilts. Very few boars are marketed as pigs, and when they are sold weighing over 60 pounds; they are discriminated against sharply. The slaughter pig schedule follows.

SLAUGHTER PIG SCHEDULE

<i>Class</i>	<i>Weight Selections, pounds</i>	<i>Grade</i>
All classes	{ Under 30 30-60	} Ungraded
	{ 60-80 80-100	
Barrows and Gilts	{ 100-210	{ Good Medium Cull

Feeder and Stocker Swine

This group is relatively small, as previously indicated. Feeder and stocker swine at the public stockyards are subject to Federal inspection by employees of the Department of Agriculture. Those diseased and rejected as feeders and stockers are sold for immediate slaughter. Feeder and stocker swine are vaccinated against hog cholera, and then dipped as a precautionary measure to prevent the carrying of disease germs or parasites that may have come in contact with the hair or feet of the animals while in the yard.

The trade in these pigs and hogs is heavy when the feeding ratio is favorable. This group includes hogs and pigs that show ability to take on, economically, additional weight and finish. They lack sufficient thickness and firmness of finish or fat to qualify for the better grades of slaughter hogs.

Following is the schedule for hogs and pigs sold as feeder pigs.

FEEDER SWINE SCHEDULE

<i>Class</i>	<i>Weight Selections, pounds</i>	<i>Grade</i>
Barrows and Gilts	Hogs {	120-140
		140-160
		160-180
	Pigs {	80 down
		80-100
		100-120
		Choice
		Good
		Medium
		Common

Choice grade feeder and stocker barrows and gilts have excellent conformation and quality. In detailed description choice feeder pigs comply with previously given specifications for top hogs but lack in size and finish.

Miscellaneous Hogs

On the hog market there are some special groups not included in the regular classification. These are of very small numbers, and the usual market quotation does not include the miscellaneous group. Following are some which are included in the miscellaneous class.

ROASTING PIGS

Such pigs weigh from 15 to 50 pounds and are dressed shipper style, that is, with the head on. They are sold as whole carcasses. A thick, short, blocky pig that is well proportioned is required to qualify as a roasting pig. They are in demand during the holiday season and they go chiefly to hotels, clubs, restaurants, and steamships, and frequently through meat dealers to consumers.

GOVERNMENTS

Pigs and hogs which fail to pass the regular antemortem inspection are retained, tagged, and killed under special govern-

ment supervision. This will include swine that are crippled, badly bruised, or show abscesses, and sows very heavy with pig.

DEAD HOGS

Hogs arriving at the market dead are disposed of by the tanking process, in which they are converted to grease and feeding or fertilizer tankage or meat scraps.

ROUGHES

Included in this group are the "throw outs" or hogs sorted out of other loads. These are coarse, rough hogs of all weights which are very inferior.

SOFT OR OILY HOG

Carcasses that are soft or oily either because of softening feeds or immaturity are less desirable than firm carcasses. It is impossible to determine the softness or hardness on foot. Where soft hogs are numerous packers buy hogs subject to meeting hardness requirement and settlement is based on the carcass and its hardness. Hogs yielding soft pork are docked two cents or more per pound. Market quotations except soft or oily hogs from the general price range for a given weight and grade.

Dockage in the Market

On some markets certain hogs are docked in weight when they are sold. The tendency has been away from this practice as it is not uniform on all markets and often where used it is subject to controversy. On some markets it is common to dock stags 70 pounds and piggy sows 40 pounds. Since the price paid is lower than for top market pigs, the practice is confusing. Also lighter individuals are docked relatively more than heavy ones. The federal report previously given recommended the elimination of "dockage" because the practice is not equitable.

HOG PRICES

Prices of hogs show much variation by days, months, and years. The wide range of variation is illustrated by the yearly average price at Chicago. Since 1880 the high year was 1919

when the average price per 100 pounds at Chicago was \$17.85. The low was reached in 1932 with a \$3.83 average.

The by-products from the slaughter of hogs are worth relatively little as compared with the carcass. Of the slaughter animals hogs have the lowest value of the by-products and the highest carcass yield. Since production in swine is so changeable, there are wide movements in prices.

The chief factors causing hog prices to change in this country, according to U. S. Department of Agriculture¹ findings, are:

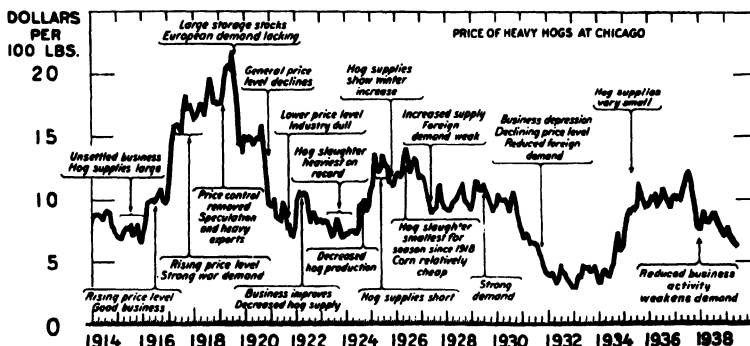


FIG. 150. Factors affecting the price of hogs. Changes in the market supplies of hogs, the demand for hog products, and the general price level of all commodities account for the fluctuations in hog prices. (U.S.D.A., Bur. of Agri. Economics.)

(1) changes in the buying power of domestic consumers, (2) variations in hog production, (3) changes in the charges for processing and distributing, (4) changes in the foreign demand for American hog products. This investigation also indicated that changes in hog prices were due to causes other than changes in marketing methods including the rapid growth of direct marketing.

The impact of the various factors affecting the price of hogs is shown in Figure 150.

Kinds of Price Changes

In behavior, hog prices tend to change with some regularity which is dependent upon the various factors which affect the

prices. The price changes may be classified into the following kinds.

1. Long-time trend.
2. Cyclical changes.
3. Seasonal changes.
4. Irregular fluctuations.

The long-time trend or secular movement has in general been the same for all kinds of slaughter animals. The prices tended downward from the close of the Civil War until about 1896, and then the tendency was upward until shortly after the first World War. Since that time there has been a drop in prices followed by an irregular trend.

Cyclical movements in prices are largely the result of the variation in hog production. Prices are high when numbers are low, and low prices prevail when we have large numbers. These cycles are the direct result of the producers expanding hog production too much when the relation of hog prices to feed prices is favorable. Likewise there is a tendency to curb hog production too much when the unfavorable situation exists. Returns to producers of hogs are largely dependent upon the balance between volume of production and the demand for pork and lard.

Seasonal variations are also due to numbers on the market. When the volume of receipts is low higher prices prevail as there is an inverse relation between marketing and prices. As farrowings are quite seasonal there is a marked seasonal variation in prices.

Short-time fluctuation in prices is also marked. The market price for hogs changes rapidly from day to day and even during a marketing day. The price paid at any given time is about that which will move the available supply and it will be at or above what the lowest seller will take.

The Hog Price Cycle

The more or less regular cycles in hog prices are shown in Figure 151. In that figure heavy hog prices at Chicago are adjusted to the 1910-1914 price level. Monthly prices are charted, as is also the price trend, which is a 12-month moving average.

The regularity in the swings of hog prices since 1860 is quite startling. The prices move in one direction for about two years and then in the other direction for an equal length of time. The cycle may take five years to complete or it may be as short as three years. We may also recognize alternate major and

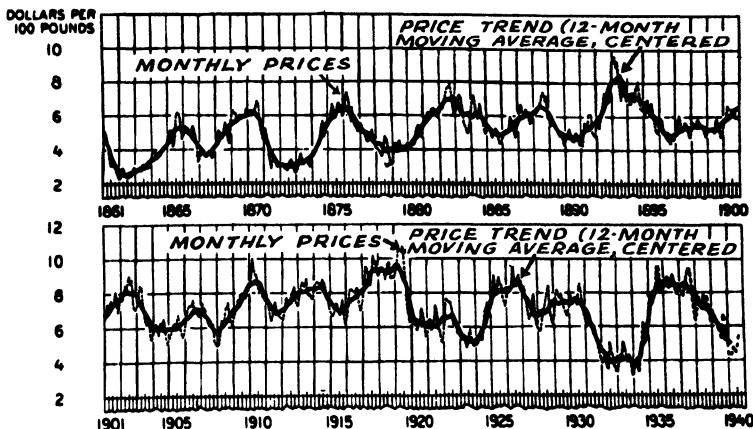


FIG. 151. Prices of heavy hogs at Chicago. Quite regular cycles in prices occur which coincide with production cycles. When hogs are numerous prices are low, and high prices prevail when hogs are scarce. (U.S.D.A., Bur. of Agri. Economics.)

minor cycles. The major cycles with greater swings are four to six years long, while the minor are three or four years in length.

These cycles of prices are due to corresponding swings in production.

Hog Prices by Classes

There is little spread in the hog market compared to the other kinds of slaughter animals. The two large classes, barrows and gilts, and packing sows, sell remarkably close together. In fact, at times (rarely) the latter group has outsold the former. On the seven markets¹ for 1938 and 1939 combined barrow and gilts averaged \$7.38 in cost per 100 pounds and weighed an average of 228 pounds. Sows on the same markets for the same period cost on the average of \$6.35 per 100 pounds and weighed

¹ Chicago, Kansas City, National Stockyards, Omaha, Sioux City, South St. Joseph, South St. Paul.

372 pounds. The packing sows made up 12 per cent of the receipts for the two years.

For the year 1939 the average price for all grades of hogs and pigs on the Chicago market was \$6.60, while hogs classified as heavy had an average price of \$6.40, light hogs \$6.90, and pigs \$6.00. While this is but one year's average, it is fairly representative in that the pigs were lower in price than the hogs, while the light hogs outsold the heavier ones.

Prices of Swine by Months

The extent of the seasonal swing in hog prices is illustrated by the tabulation of the average price by months on the Chicago market. In comparing prices with receipts by months, see page 377 and table below. It will be noted that months of heavy receipts are those of low prices.

The average prices of hogs on the Chicago market follow.

HOGS — WEIGHED AVERAGE PRICE PER 100 POUNDS
AT CHICAGO, 1930-1939 AVERAGE

<i>Month</i>	<i>Average</i>
October	7.21
November	6.73
December	6.44
January	6.65
February	6.88
March	7.10
April	6.87
May	6.80
June	6.86
July	7.11
August	7.22
September	7.49
Average	6.85

There are two peaks in hog prices. The spring peak in March occurs when most of the spring pigs have been marketed and fall pigs are not being marketed in volume. A summer peak occurs in August or September after most of the fall pigs have been marketed. With light hogs the summer peak is the highest while with heavy hogs the peak in the spring is about the same as that of the previous fall. With expanding production, the summer peak is lower than the spring peak of that year, but when hog numbers are decreasing, the reverse is usually true.

Hog-Corn Price Ratio

The number of bushels of corn which is equal in price to 100 pounds of live hogs is termed the hog-corn price ratio. This is not the corn required to produce a hog or 100 pounds gain on a live hog. It is merely a ratio that is helpful in determining the relative profitableness of marketing corn direct as compared to feeding it to hogs. As the ratio narrows, farmers sell the corn

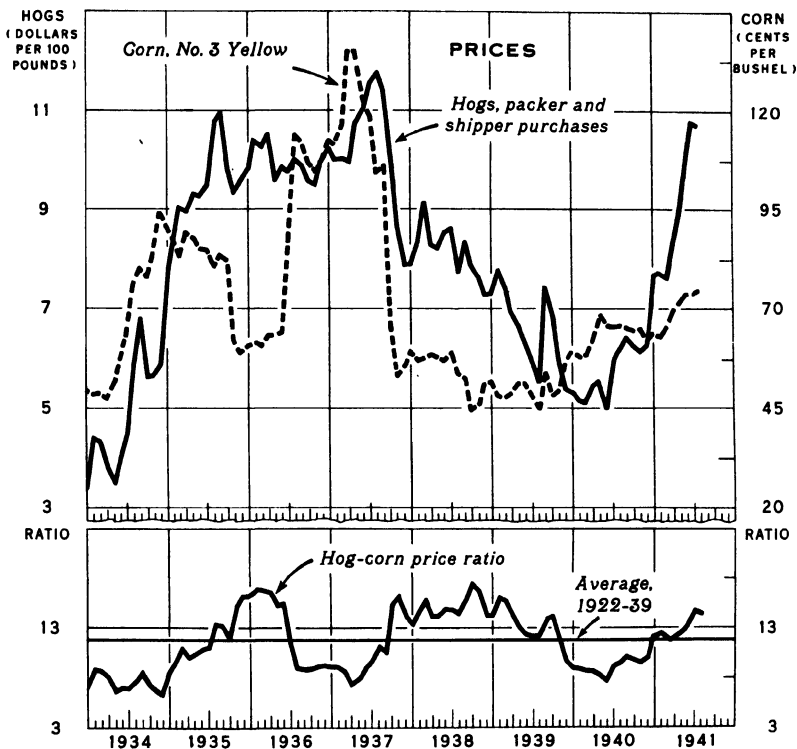


FIG. 152. Prices of hogs and corn and hog-corn price ratio. When the hog-corn price ratio is wide, expansion takes place. When it is narrow, there is a reduction in hog numbers. (U.S.D.A., Bur. of Agri. Economics.)

and their hogs. With a wide ratio, hogs are fed to heavier weights and hog production is expanded.

The price of corn and hogs at Chicago is shown in Figure 152 as well as the hog-corn price ratio. The average hog-corn ratio is slightly under 13. In other words 100 pounds of live hogs will sell for the same amount of money as a little less than 13 bushels of No. 3 yellow corn at Chicago.

Chapter 26

HOG SLAUGHTER — PORK AND LARD — BY-PRODUCTS

HOG SLAUGHTER

As the interior packers have expanded, there has been a big shift in the place of hog slaughter. The amount of hog slaughter in the northwestern corn belt states (Minnesota, Iowa, North Dakota, South Dakota, and Nebraska) has shown more change than federal inspected hog slaughter in other areas. For the year of 1920 about 22 per cent of the slaughter was in those states, and by 1930 it was up to 30 per cent. Since then the proportion has not changed markedly. The expansion in those states was accompanied by retraction elsewhere, especially in the southwestern corn belt states (Missouri and Kansas).

With the westward shift in swine production there has been a marked tendency to decentralize pork packing. A few new plants have been built in the northwestern corn belt, but in the main the change has been merely a shift in the volume of slaughter at the plants in the different areas. More plants are slaughtering hogs than other livestock, and the farm slaughter is also greater.

A classification of hog slaughter for the ten years 1930-1939 showed that 63 per cent of the hog slaughter was federally inspected and done in establishments conducting a wholesale business. Such organizations also accounted for 9 per cent of the total slaughter which was not under federal inspection. The pork and lard so prepared is limited mainly to intrastate trade. Retail establishments or retail dealers accounted for 6 per cent of the total slaughter, while slaughter on farms constituted the balance or 22 per cent of the total. Since 1900 there seems to have been no great change or tendency in the hog slaughter by the various types. There was a slight increase in farm slaughter

and a corresponding slight decrease in wholesale slaughter. The four large national packers handle a smaller proportion of hogs than other kinds of livestock. In 1939 there were 211 establishments operating under federal inspection which killed an average of 196,000 head of hogs per plant for the year.



FIG. 153. Slaughtered hogs on the overhead carrier. As the hogs move along the rail at 20 feet a minute the steps in dressing take place. (The Rath Packing Co.)

Hog slaughter is unique in that the carcasses are seldom sold as such, as is the case with beef, veal, mutton, and lamb. Most hog carcasses are reduced to the wholesale cuts at the place of slaughter. Of these cuts, roughly 15 to 20 per cent of the carcasses is sold to consumers as fresh pork while the remainder is cured, rendered into lard, or made into meat products before it is retailed.

Centers of Hog Slaughter

There are several large centers of hog slaughter. The slaughter by stations merely gives the number slaughtered at

those points, which in some cases is exceeded by slaughter at several of the interior plants. Some of the interior packers slaughter a million hogs in a year. The slaughter under federal inspection by stations is given below.

HOGS — SLAUGHTER UNDER FEDERAL INSPECTION
BY STATIONS, 1930-1939 AVERAGE¹

<i>Station</i>	<i>Thousands</i>
Chicago (includes Elburn, Illinois)	5,383
St. Louis (includes National Stockyards and East St. Louis, Illinois)	2,645
New York (includes Jersey City and Newark, New Jersey)	2,208
Kansas City	2,027
South St. Paul (includes Newport and St. Paul)	1,985
Omaha	1,750
Sioux City	1,187
Denver	320
All other stations	22,163
Total	39,669

This table is the number of head slaughtered at a station which in some cases includes more than those at the stockyards market in that area. For example the number slaughtered at Kansas City is more than the receipts at the Kansas City public stockyards market. As the above list includes a selected group of slaughter points based upon all kinds of livestock, several large hog slaughter centers are not included. For example, nearly a million hogs are slaughtered annually at St. Joseph, Indianapolis, and Cincinnati. The eight slaughter centers listed above account for a little over one-half of the slaughter under federal inspection.

Hog Slaughter by Months

Of all the kinds of livestock, the slaughter of hogs is the most seasonal. The slaughter parallels the receipts by months, which has been previously given, as nearly all of the hogs marketed are slaughtered and there is but little trade in feeder pigs.

December and January are the months of heaviest federally inspected slaughter, and these months each will have 10 to 12 per cent of the yearly slaughter.

¹ *Agricultural Statistics*, U.S.D.A., 1940, p. 377.

The heavy receipts and lowest prices occur in December and January, but this is offset in part by the demand for storage. Heavy storage on the other hand tends to have a depressing effect upon hog prices the following summer.

Hog Slaughter, Proportion by Classes

Sows including gilts usually predominate slightly in the hog slaughter under federal inspection, although in some years barrows outnumber the sows in the kill. In years of expanding hog numbers more sows are retained on the farm and the proportion slaughtered is lowered. When liquidation is taking place, sows predominate, but the percentage in the slaughter is seldom over 52 per cent. Less than 1 per cent of the slaughter is made up of stags and boars.

Slaughtering Hogs

In the driving of hogs or pigs, care should be taken to see that they are not unduly rushed. Sticks or clubs are to be used with caution as they make bruises which affect the value of the carcass. Flat canvas straps are effective and harmless. Pigs are driven to the packing plant and are held in a small pen for shackling.

The hogs are shackled just above the hoof on the hind leg and then hoisted to an overhead rail. They pass along suspended from the rail to the "sticker" who sticks the pig with a knife in the center of the neck just ahead of the sternum. After bleeding for about ten minutes the hogs are dropped into the scalding vat in which the water temperature is about 140° F. Next is the dehairing process in which the hog is passed by chain through a dehairing machine. Following this, the gamb cords of the hind legs are exposed, hooks or a gambrel are placed in the cords, and the hog is again hung from the rail. Further cleaning and scraping by hand and washing are essential, and finally they are subjected to singeing by means of gas torches playing on all parts of the body. The animal must be absolutely and completely dehaired before it can be opened other than sticking and baring the gamb cords.

As the hog is moved along suspended on a trolley which moves on an overhead track, the various steps in dressing take place,

and finally the cleaned dressed carcass is moved into the cooler. The various steps in dressing are (1) heading, or removing the head; (2) opening the carcass; (3) cutting free the bung which is then tied and dropped down; (4) removing the viscera which



FIG. 154. Government inspectors at work. Each carcass is carefully examined for signs of disease. That unfit for food is rejected. (The Rath Packing Co.)

includes the liver, heart, lungs, large and small intestines, pancreas, spleen, stomach, bladder, and their fat coverings; (5) splitting down the center of the back bone; (6) removing the leaf fat; (7) facing or trimming the inside of the hams; (8) finally the carcass is washed and then sent to the coolers.

During the dressing process inspections are made of the head, viscera, and carcass by inspectors from the U. S. Department of Agriculture Bureau of Animal Industry.

Two styles of dressing are common. The two methods are described below.¹

1. The packer style is the one most generally used. The carcasses of all classes of slaughter hogs that are to be converted

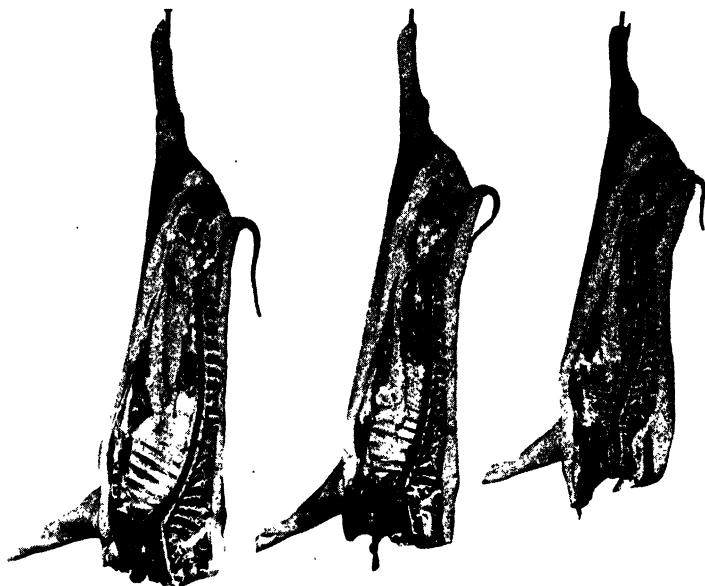


FIG. 155. Dressed carcasses of large, intermediate, and small type hogs slaughtered at approximately 225 pounds. Note the greater length of the large type on the left as compared with the shortness of the small type on the right. (O. J. Hankins, Bureau of Animal Industry.)

into primal cuts of pork are usually dressed in this manner. The carcasses are opened from crotch to neck and the backbone is split full length through the center. The heads, without the jowls, are removed, and the leaf fat is lifted but usually left in.

2. The shipper style is the one usually used for slaughter pigs, which are most often sold as whole carcasses in the wholesale trade. The carcass is opened from the crotch to the tip of the breastbone, the backbone is left intact, and the leaf fat is

¹ Don J. Slater, "Market Classes and Grades of Swine," *Circ.* 569, U.S.D.A. September 1940.

left in, as a general rule. The entire head is left attached. Those that weigh under 30 pounds also are "squatted," that is, placed on their bellies in a trough with the front legs doubled back from the knee joint and the hind legs extending straight back from the hams. They are sold for roasting whole, usually during the winter holiday season, and are generally considered a delicacy.

Dressing Percentage

The hog is dressed with the skin and the shanks on. The barrel and chest cavity are relatively smaller than on other slaughter animals. As a consequence, hogs dress high.

Following are typical yields for the several classes of slaughter hogs.¹

<i>Kinds of Hogs</i>	<i>Dressing Per Cent, Including Head</i>
All weights and classes	72 to 80
Smooth, heavy hogs	79 to 80
Good, fat type hogs	78
Sows	72 to 77

For a ten-year period the average dressing yield of hogs slaughtered in the United States was 75.13 per cent based on a monthly survey of wholesale slaughterers by the U. S. Department of Agriculture, Agricultural Marketing Service. The average live weight for the same period is given as 229.25 pounds. A study of the dressing percentage of 1000 hogs in the International Livestock Exposition carcass contest with hogs weighing from 139 to 739 pounds and dressed with the head on and leaf fat in showed an average of 82.15 per cent.²

When dressed packer style, the yields are about 8 per cent less than shipper style dressed carcasses because of the removal of head, leaf fat, kidneys, and ham facings.

Yields are usually calculated on the dressed weight of the carcass when chilled. The warm dressed weight is higher than the chilled dressed weight as there is a "cooler shrinkage" which amounts to about 2.5 per cent.

¹ W. C. Davis, B. F. McCarthy, and J. A. Burgess, "Market Classes and Grades of Pork Carcasses and Fresh Pork Cuts," *Circ.* 283, U.S.D.A. October 1933.

² *Armour's Letter to Animal Husbandmen*, Vol. 7, No. 2, May 1926.

Federal Meat Inspection of Swine

The number of hogs and pigs condemned in the antemortem inspection is relatively small. In fact, 99.72 per cent of the hogs pass the on foot inspection. Of those passed on foot, carcass condemnations are likewise low, as 99.76 per cent pass the inspection. In the classification of causes of condemnation,



FIG. 156. A Berkshire barrow of the intermediate type. A breed champion at the International Livestock Exposition.

pneumonia, pleurisy, enteritis, and peritonitis jointly are credited with the greatest number, followed by septicemia and pyemia, tuberculosis, and hog cholera. Sexual odor is also a condemnation cause and it is not common in other slaughter animals. In the inspection of swine carcasses there is a sizable condemning of carcass parts because of tumors and abscesses, tuberculosis and injuries showing up in the meat.

PORK AND LARD

Meat from Swine

Pork is the meat derived from swine and it is sold as "fresh meat," which is that which has undergone no substantial change in character since the time of slaughter, and "cured meat." The latter is the clean, sound product obtained by subjecting meat to a process of salting, by the employment of dry common

salt or of brine, with or without the use of one or more of the following: sodium nitrite, sodium nitrate, potassium nitrate, sugar, sirup, honey, or spice.

Disposition of the Swine Carcass

Almost all hog carcasses are cut up at the slaughtering plant and sold in the form of wholesale cuts. There is a small trade in roasting pigs and slaughter pigs, which are sold in carcass form. Not more than from 1 to 2 per cent of the hog carcasses from a large packing plant are sold whole. A large part of the carcass is cured as ham, bacon, or salt pork, or rendered for lard.

Market Classes and Grades of Pork

Since the hog carcass is not sold fresh to the extent that lamb and beef carcasses are, the classification is somewhat different. One carcass may excel for fresh pork another for smoked meats and still another for dry salt curing. Pork carcasses and cuts are graded on the three fundamental characteristics applicable to all kinds of meat cuts, conformation, finish, and quality. Weight is not a grade factor, but it is important in market value, since it is related to size of the pork cuts.

A description of the terms "conformation," "finish," and "quality" follows:¹

The term "conformation" refers to the general build, form, shape, and contour or outline of the carcass, side, or cut. Conformation is determined by the skeleton, the depth or thickness of lean meat, and the thickness and distribution of external fat. It involves plumpness and blockiness or stockiness on the one hand and ranginess, lankiness, and angularity on the other. These terms refer to the extreme limitations of conformation, between which are placed all the modifications and degrees that apply to the various grades.

Because of economic conditions in the pork industry, resulting largely from a pronounced trend of consumer demand toward leaner pork cuts, together with the development of competition between lard and vegetable oil products, a new type of hog differing materially from the fat type (butcher) has been developed. This market type consists of what are known as

¹ From *Circ.* 288, U.S.D.A.

“meat type” hogs, and seems to meet the economic needs of the industry satisfactorily. With its development some of the heretofore desirable features of conformation involving thickness, fullness, plumpness, and stockiness have undergone material changes.

Two distinct types of hogs are involved; consequently there are marked differences in conformation of the two types and in the relation of conformation in each instance to finish. Quality of flesh (lean meat) of comparable grades from the two types does not show any appreciable difference and except from a quantitative standpoint should not be considered. Briefly, the



FIG. 157. Large type and small type pig. Pigs in between these two in length produce carcasses of greatest acceptability to the consumer.

meat type produces a higher yield of desirable major cuts, that require less trimming, than does the fat type. It follows that conformation of pork carcasses is affected to some extent by the type of hog. The most desirable conformation in pork carcasses, from both an economical and general desirability standpoint, is represented by well-finished meat type carcasses which involve smoothness, moderate fullness, thickness, compactness, and adequate, uniform fat distribution, thickness of back fat averaging about one and one-half inches with variations above and below, depending upon the size and weight of the carcass.

Finish in pork refers to the thickness, color, character, and distribution of fat. The internal indications of high finish are generous quantities of firm white fat in the crotch, around the kidneys, over the ribs, and along the breast bones. A high

degree of finish adds much to the attractiveness of the carcass or cut, but its chief significance lies in the fact that there is evidence that up to a certain point intermuscular and intercellular fat is associated with palatability. Furthermore, finish without wastness serves as an excellent index of the degree of quality in the meat. Thick or wrinkled skin, a lack of fat in the crotch, poorly covered kidneys and ribs, and general scarcity of fat along the breast bones are indications of poor finish.

Quality is a characteristic of the lean flesh and of the fat included therein. It pertains primarily to the thickness, firmness, and strength of both the muscle fiber and the connective tissue. It also involves the quantity, consistency, and character of juices or extractives that surround and permeate the muscle fiber and connective tissue. Color is not actually a factor of quality, but is an excellent indication of the quality of a given piece of meat. Color in meat is of special commercial importance and influences the market value.

Best quality in pork implies full, well-developed, firm, muscular tissue of flesh, with a minimum of strength in fiber and connective tissue. Such carcasses or cuts usually have a thin, smooth skin and are free from wrinkles. The most desirable color in fresh pork from standpoint of marketable value is grayish pink. The flesh is relatively firm and fine grained, and is free from excessive moisture. The cuts, when chilled, hold their natural shape. The difference in color between pork carcasses and cuts of different grades, although considerable, is not so great as, for instance, in beef, veal, and lamb of different grades.

Because of marked uniformity in the age at which most hogs are slaughtered there are ordinarily only moderate differences in color of the flesh, except in carcasses of old sows, boars, and stags. Firmness of flesh is always an indication of quality. High quality in pork carcasses is also indicated by firm, thin, smooth skin, free from wrinkles; low quality is indicated by harsh, rough, coarse, and wrinkled skin.

Most pork produced in the United States is more uniform in quality than is any other class of meat, therefore there is need for fewer grades. Instead of being divided into six or seven grades as are beef, lamb, and mutton, pork carcasses are divided

into not more than four grades, which are sufficient for all commercial purposes. In fact, three grades cover all major pork cuts except a small percentage of regular hams and bellies from Cull grade carcasses, which cuts, although possessing unusually low quality characteristics, have been found satisfactory for certain classes of trade. A fourth grade referred to as "Cull" is provided for these hams and bellies. The terms used to designate the grades of pork carcasses are No. 1, No. 2, No. 3, and Cull. Except boar carcasses, each class of pork carcasses has the same number of grades.

The dressed pork carcass schedule is as follows.

DRESSED PORK CARCASS SCHEDULE

<i>Class</i>	<i>Use Selection of Carcasses</i>	<i>Weight Range, Pounds</i>	<i>Grade</i>
Barrows and gilts	Roasting pork	10 to 30	No. 1 No. 2 No. 3 Cull
	Shipper pork	80 to 110	No. 1 No. 2 No. 3 Cull
	Meat type pork	130 to 240	No. 1 No. 2 No. 3 Cull
	Fat type pork	130 to 240	No. 1 No. 2 No. 3 Cull
Sows	Sow (packing) pork	200 to 320	No. 1 No. 2 No. 3 Cull
Stags	Processing or manufacture	200 to 400	No. 1 No. 2 No. 3
Boars	Manufacture (inedible)	All weights	Ungraded

Wholesale Pork Cuts

In dressing hogs the carcass is moved to the cooler very soon after dressing and it is chilled as rapidly and thoroughly as



WHOLESALE CUTS—PERCENTAGE OF CARCASS

1-Hind Feet	1.00%	8-Picnic	7.50%	12-Jowl Butts	2.25%
2-Hams	19.00	9-N. Y. Style		(Trimmed)	
3-Clear Bellies	16.50	Shoulder	16.00	13-Boneless Butt	3.05
4-Pork Loins	12.75	10-Neck Bones	.95	14-Boston Butt	5.20
5-Spare Ribs (F.S.)	2.50	11-Picnic Butt	3.02	15-Loin Butt	4.00
6-Spare Ribs (H.S.)	1.50	12-Jowl Butts		16-Fore Feet	.92
7-Brisket	2.25	(Untrimmed)		16-Leaf Fat	3.52

DISTRIBUTED COURTESY
NATIONAL LIVESTOCK AND MEAT BOARD
407 SOUTH DEARBORN STREET
CHICAGO, ILL.

FIG. 158. The wholesale cuts of pork and the percentages of each cut.
(U.S.D.A.)

possible. The temperature at which the cooler is kept is dependent upon the time used for cooling. The carcass may be chilled in one day, that is, 24 hours, or two or three days may be used. Refrigerator temperatures are generally about 34° F., but the coolers to which warm carcasses are moved are kept at 25° F. or lower.

After chilling, the carcasses are brought to the cutting floor and reduced to wholesale cuts. There is much variation in cutting due to the requirement of the trade or demand.

The common wholesale pork cuts are shown in Figure 158.

The main divisions of the carcass for domestic use are the hams, shoulders, and sides. These divisions are further divided into wholesale cuts. The size of the carcasses and the method of curing as well as the demand, influence the exact cutting methods. For example, hog carcasses of sufficient size will have a fat back which can be cured by the dry salt method, while with lighter carcasses and insufficient thickness to the fat back it is rendered into lard.

The pork cuts are the ham, shoulder, loin, and bacon belly and because of their relatively higher value per pound they make up about three-quarters of the value of the carcass. Hogs with weight range of 180 to 200 pounds will have about 45.5 of their live weight in these primal cuts. The yield apparently goes up until the hog reaches a weight of 260 pounds and then it declines. Hogs weighing 350 to 400 pounds will have only about 40 per cent of their weight in the primal cuts, and correspondingly higher yields of fat cuts and lard.

Trimming the Bacon Belly

The cutting floor pork cut "rough belly" is trimmed into a bacon side suitable for the trade. After the side has been put through a roller, it is trimmed even on the edges into a square cut belly. The side is then cut through the mammary gland and this is called the teat trim. If the mammary gland or seed show pigmentation, a further trim or seed trim is necessary. The final bacon slab is known as the "clear belly" which is seedless and trimmed square. The pigmented seed or "seedy cut" may be black, red, or white. An investigation of the occurrence of the seedy cut at Wisconsin Agricultural Experiment

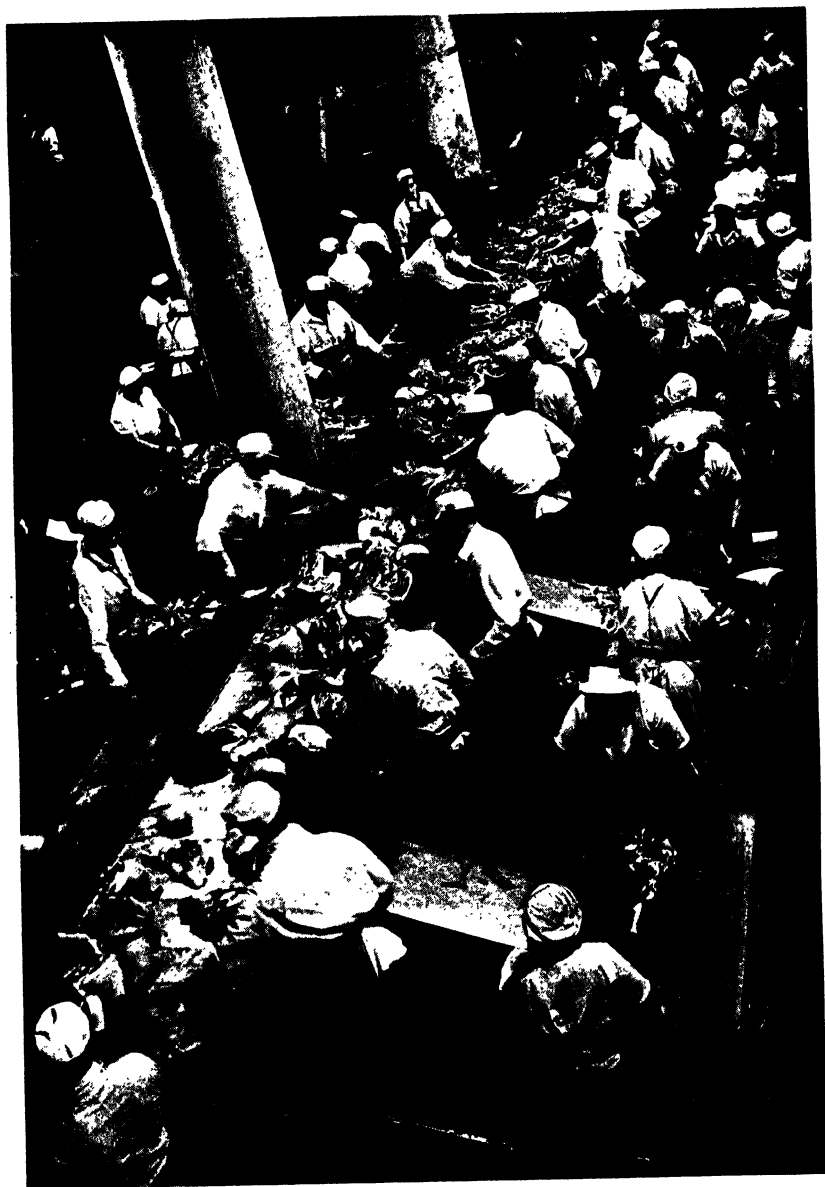


FIG. 159. The pork cutting room in a packing plant. In this plant 350 people take part in cutting up the hog carcass. (The Rath Packing Co.)

Station¹ lead to the following findings. The black is present in the black breeds to the extent of 50 per cent of the gilts and 9 per cent of the barrows. The black and white breeds have 23 per cent of black seed in the gilts and 6.5 per cent in the barrows. The common red breed had 20 per cent of black seed in the gilts and none in the barrows. The barrows and gilts of white breed are free from black seed. Sows and stags of all the breeds are apparently not black seeded. There is also a red, pink, or vascular seed which appears in immature gilts. It is related to the oestrous cycle.

As bacon is the highest priced common wholesale cut, the presence of the seedy cut is of economic importance. Trim-mings from bacon sides are used for lard or, if comparatively lean, in sausage.

Wholesale Prices of Pork

Data are available for the average price of common wholesale pork cuts on the New York market for a period of time. These prices reveal the relative demand, as the processors price the cuts so as to move them into consumptive channels.

Cured pork products with the exception of fat back, dry salt cured and picnics sell for more than the usual fresh pork cuts.

Listed below are the several pork cuts for which data are available on the New York market for a ten-year period.²

<i>Pork Cuts</i>	<i>Average Price per Hundred Pounds, New York, 1930-1939</i>
Backs, dry salt, 12-14 pounds average	\$10.81
Spareribs, half sheets	11.85
Shoulders, New York style skinned, 8-12 pounds average	13.74
Picnics, smoked, 4-8 pounds average	14.13
Butts, Boston style, 4-8 pounds average	16.11
Loins, 8-10 pounds average	18.13
Smoked hams No. 1, regular, 12-14 pounds average	20.58
Skinned hams No. 1, 16-18 pounds average	21.01
Bacon, smoked, No. 1 dry cure, 8-10 pounds average	23.69

¹ L. J. Cole, J. S. Park, and Alan Deakin, " 'Seedy Cut' as Affecting Bacon Production," *Research Bull.* 118, Wis. Agr. Expt. Sta., September 1933.

² *Livestock, Meat and Wool Market Statistics and Related Data*, U.S.D.A., A.M.S., May 1940.

Fat backs are the lowest priced of the quotable cuts. The fat back demand is mainly in the South. However, when the purchasing power of persons who commonly use the fat backs is



FIG. 160. Packing hams in vats for curing (Armour and Co.)

higher than usual they switch to more desirable cuts.

Bacon is the highest priced wholesale cut on the basis of the quality listed, that is, No. 1 dry cure, weight 8 to 10 pounds. Deviation from this weight is accompanied by a lowering of the price.

Retail Prices of Pork

Some comparative figures are available on the retail prices of pork and lard. Those listed below are for the ten-year period 1930-1939 for the United States and for New York City.

RETAIL PRICES

	<i>United States, Cents per Pound</i>	<i>New York City, Cents per Pound</i>
Pork chops	29.88	30.32
Bacon, sliced	34.66	35.55
Hams, sliced	44.05	44.89
Lard	13.66	
Smoked hams		26.11
Strip bacon		30.61
Smoked picnics		18.30
Lard, carton		14.25

Sliced ham (center cuts) is the highest priced common pork cut on the retail market followed by bacon and pork chops. Ham sells for more than bacon only when the center cuts are sliced for the trade. Of the common retail meat cuts on which retail prices are available for a period of time in New York,¹ sliced ham is outsold by one meat cut, porterhouse steak. It is obvious from the above that the lean cuts are the highest priced.

Hog Types and Yield of Wholesale Cuts

A certain amount of fatness is essential in a hog carcass to give acceptable pork cuts. Carcasses too lean will lack thickness to the cuts such as the bacon, and the cuts will usually lack

¹ Quoted in *Livestock, Meat and Wool Market Statistics*, U.S.D.A., A.M.S., 1940.

firmness and attractiveness. Fat carcasses need to be heavily trimmed and have relatively heavier fat cuts.

APPROXIMATE PERCENTAGES OF CARCASS WHOLESALE CUTS
AND PRODUCTS IN ONE HUNDRED POUNDS OF LIVE HOG¹

Item	Live Weight Range, Pounds, 180-250	
	Carcass Weight Range, Pounds	
	128-180	124-178
	Choice Lard Type	Choice Meat Type
Belly—sweet pickle	11.20	10.65
Belly—dry salt	..	..
Loins	8.90	9.95
Hams	13.30	13.80
New York shoulder 1½ rib	10.75	11.25
Jowl	1.85	1.50
Spareribs	1.55	1.70
Neckbones	.85	1.00
Feet	1.85	2.00
Tail	.20	.20
Lean trimmings	2.50	3.00
Fat trimmings	7.35	6.30
Rough fat backs*	9.75	7.50
Cutting shrinkage	1.25	1.15
Total carcass†	71.30	70.00
Liver	1.40	1.40
Heart	.25	.25
Kidney	.20	.20
Head	4.60	4.65
Leaf fat	2.15	2.05
Scrap leaf fat	.15	.15
Caul fat	.50	.55
Ham facing	.30	.35
Killing shrinkage and other products	19.15	20.40
Total live hog	100.00	100.00
Lard yield‡	15.50	12.75

* Commercial fat backs should weigh 6 pounds or over after trimming, otherwise they are used as lard. Trimmings amount to about 2 pounds on lightweight fat backs and 3 pounds on heavier ones.

† Leaf fat, ham facings, kidney, and head removed.

‡ Lard yield: Choice grade — leaf fat 94 per cent, fat backs 80 per cent, caul 65 per cent, trimmings 70 per cent, ham facing 75 per cent; Good and Medium grade — leaf fat 90 per cent, fat backs 75 per cent, caul 60 per cent, trimmings 65 per cent, ham facings 70 per cent.

¹ Arthur T. Edinger, *Meat Cutting and Pricing Methods*, U.S.D.A., A.M.S., November 1940.

A comparison of the cuts from the lard or fat type hog and the meat type hog of comparable weights and quality illustrates the difference in yields.

It will be noted that the meat type has a lower carcass and lard yield but excels in leaner cuts. When the lean cuts are in a stronger demand than fat cuts and lard, which is usually the case, the meat type will have the higher cut-out value. Tests which stop at carcass yield or dressing percentage may therefore give an incorrect idea for the meat returns from a hog.

There is also a difference in the yields of small, medium, or intermediate and large type hog carcasses of comparable weight and grade. As the smaller type hog is higher in finish at a given weight than the large type, they have higher yields of high fat yielding cuts. On the basis of the same degree of fatness the yields are fairly comparable.

The data tabulation indicates the yield differences of these different types of uniform weights and uniform fatness.¹

CARCASS YIELDS OF LARGE, INTERMEDIATE, AND SMALL TYPE HOGS

	<i>At Uniform Weight</i>			<i>At Uniform Fatness</i>		
	<i>Large Type</i>	<i>Inter-mediate Type</i>	<i>Small Type</i>	<i>Large Type</i>	<i>Inter-mediate Type</i>	<i>Small Type</i>
Number of hogs	96	137	42	26	67	59
Final feed lot weight—pounds	224	223.1	223.2	261.9	223.2	149.6
Market grade of slaughter hog	Good	Low	High	Low	Choice	Choice
Market grade of chilled carcass	Good	Low	High	Low	Choice	Choice
Chilled carcass weight—pounds	166.7	164.6	174.1	202.5	168.4	110.8
Dressing percentage	74.3	73.6	78.2	77.2	75.3	74.0
Carcass yield of certain cuts—per cent						
Ham	19.7	18.8	17.7	18	18.1	18.2
Bacon	12.4	12.8	13.6	12.3	11.9	12.6
Loin	14.7	14.1	13.3	14.4	14.2	13.1
Total of ham, bacon, and loin	46.8	45.7	44.6	44.7	44.2	43.9
Shoulder	9.9	9.3	8.8	8.1	8	8
Butt	5.1	4.9	4.2	4.8	4.9	4.5
Back fat (skinned), leaf fat, and fat trimmings	14.4	16.6	20.7	18.8	18.7	18.7

¹ O. G. Hankins, *A Study of Carcass Characteristics in Relation to Type of Hogs*, American Society of Animal Production, 1940.

This study leads to the conclusion that of the types studied the intermediate most nearly meets current requirement. Also this type embodies to the greatest extent possibilities for modification.

Buying Hogs on Carcass Yields

In many countries slaughter animals are purchased on the basis of carcass grade and weight rather than on foot grade and weight. Nearly all of the slaughter hogs in Denmark, Sweden, and Canada and some in Great Britain are sold on that basis.

The selling of hogs on the basis of a guaranteed dressing percentage flourished for a time in this country. This practice started in the eastern corn belt, where it was initiated by co-operative shipping associations in 1923, and expanded until about 1930 and then declined. In this plan the sales were made on the basis of the on foot grade and the carcass weight.

In Canada selling on the basis of carcass grade and weight has been highly successful, and is mandatory in plants killing over 3000 head per year. Government graders are responsible for the grading and the weighing in automatic scales. Their export demand calls for a specific type, weight, and grade of hog. Their market objective is therefore an exportable Wiltshire side. Our market is much more diverse by comparison.

The system of selling hogs on the basis of dressing percentage and carcass grade has the following decided advantages, according to W. O. Fraser.¹ (1) It provides for paying each farmer for the exact amount and grade of pork he produces which after all is the objective of the feeder in raising hogs. (2) It makes possible the positive identification of hogs that are soft and oily and the purchase of such hogs on the basis of their correct value. (3) It makes it possible to trace the origin of bruises and correct their source. (4) It provides for determining the origin of diseased hogs and for correcting the cause that may have been responsible for the diseased condition.

The arguments seem to favor buying by carcass grade and weight, but there are many difficulties to overcome in this country in initiating such a plan. Our present system tends to level off prices and often individual producers fail to receive the

¹ *Report*, American Society of Animal Production, 1938.

value they should for their hogs, although the packer pays what the entire kill is worth.

Cured Pork

Much of the pork carcass may be cured. Some of the more commonly cured pork cuts are hams, bacon bellies, picnics, skinned shoulders, boneless butts, Boston butts, fat backs, jowls, bacon squares, and boneless loins.

There are two common ways of curing pork cuts. They are:

Sweet pickled cured cuts are the prepared pork meat which has been cured by soaking in, with or without injecting into it, a solution of common salt with sugar, a sirup, and/or honey,

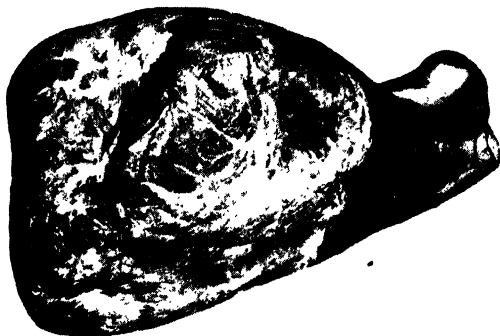


FIG. 161. A cured smoked ham. One of the highest priced pork cuts.
(National Livestock and Meat Board.)

together with one or more of the following, each in its proper proportion: sodium nitrite, sodium nitrate, potassium nitrate, with or without the use of spice.

Dry salt pork is the prepared pork cut which has been cured by the application of dry common salt, with or without the use of one or more of the following: sodium nitrite, sodium nitrate, potassium nitrate, sugar, a sirup, honey, spice; with or without the injection into it of a solution of common salt to which may have been added one or more of the following: sodium nitrite, sodium nitrate, potassium nitrate, sugar, a sirup, honey.

Often the cured cuts are smoked by subjecting them to the direct action of the smoke of burning wood or similar burning material.

Lard and Pork Fat

Lard is rendered from the fat of hogs. In the rendering process, fat is melted out from the fatty tissues and the moisture is driven off.

Because of the different materials used in rendering, there is a differentiation in the products from the hog carcass. That difference is indicated by the definitions.

Lard. Lard is the fat rendered from fresh, clean, sound, fatty tissues from hogs in good health at the time of slaughter,



FIG. 162. A ham prepared for the table. (National Livestock and Meat Board.)

with or without lard stearin or a hardened lard. The tissues do not include bones, detached skin, head fat, ears, tails, organs, windpipes, large blood vessels, scrap fat, skimmings, settlings, pressings, and the like, and are reasonably free from muscle tissue and blood.

Rendered Pork Fat. Rendered pork fat is the fat other than lard, rendered from clean, sound carcasses, parts of carcasses, or edible organs from hogs in good health at the time of slaughter, except that stomachs, tails, bones from the head, and bones from cured or cooked pork are not included. The tissues rendered are usually fresh, but may be cured, cooked, or otherwise pre-

pared and may contain some meat food products. Rendered pork fat may be hardened by the use of lard stearin and/or hardened lard and/or rendered pork fat stearin and/or hardened rendered pork fat.

That which is designated as rendered pork fat comes mainly from the trimmings of cured meats. In usual packing plant operation it will amount to about 15 per cent of lard in volume of production.

Types of Lard

Lard may be classified on the basis of the part of the carcass from which it is derived and the method of rendering.

The various common kinds of lard are:¹

KETTLE RENDERED LEAF LARD

This type of lard is made from leaf fat only. It is rendered in an open kettle which is steam jacketed. It is rendered at a temperature of from 230 to 250° F. This lard has excellent keeping qualities, it is light in color, and has a firm, grainy texture. The flavor is mild and pleasing.

KETTLE RENDERED LARD

This type of lard is made from back fat and leaf fat, usually in equal amounts, although the proportions may vary. It is rendered in a steam-jacketed open kettle at 240 to 260° F. Kettle rendered lard is light in color, but is somewhat darker than kettle rendered leaf lard. It is slightly grainy in texture, has a pleasing, nutlike flavor and very good keeping qualities. It will be noted that the manufacture of kettle rendered lard differs from kettle rendered leaf lard in two particulars: (1) back fat is used in addition to leaf fat, (2) the rendering temperature is slightly higher.

PRIME STEAM LARD

Prime steam lard is made by rendering the fat in direct contact with steam in a closed tank under pressure of from 30 to 50 pounds. The temperature is about 285° F. It usually is

¹ From *Food and Nutrition News*, Vol. IX, No. 3. National Livestock and Meat Board.

cooled rapidly and therefore has a smooth texture. This type of lard represents the bulk of the lard on the market.

NEUTRAL LARD

Neutral lard is made entirely from leaf fat. It is rendered at a very low temperature of around 120° F. It is used almost entirely in the manufacture of oleomargarine.

DRY RENDERED LARD

This type of lard is essentially a kettle rendered lard, except that the fat is melted in a closed container, usually under reduced pressure in order to reduce the action of the oxygen in the air on the fat while at a high temperature. Dry rendered lard has a fine flavor and excellent keeping qualities. This method of rendering is coming into more general use.

HYDROGENATED LARD

This is usually made from steam rendered lard to which extra atoms of hydrogen have been added. Such lard is bland, and also has a high smoke point, and is more resistant to rancidity than ordinary lard. The hydrogenated lard is whiter than usual lard and in many respects is quite similar to the hydrogenated vegetable shortenings.

LARD SUBSTITUTES

Lard substitutes are manufactured products containing vegetable fat and oil and are used in place of lard. Cottonseed oil is the main material used in such products. These substitutes have increased greatly in usage, and in general they sell for a higher price than lard.

Lard Prices and Hog Prices

The prices of hogs and lard tend to move together; however, the margin between the two has narrowed considerably in recent years. Export demand has been lessened and domestic demand has not been sufficient to keep the lard price much higher than that for live hogs. A comparison of prices of hogs and lard is shown in Figure 163.

Soft Pork

There are two main causes of softness in hog carcasses. First that which is caused by oily feed, and second, that softness which is due to immaturity and lack of finish. The latter type of softness may be recognized on foot since this is in under-finished hogs. Softness resulting from oily feeds cannot be identified on foot. The wider use of soy beans in swine rations results in more soft hogs. Peanuts are an old offender in the soft pork problem. Oily feeds such as these must be fed in limited

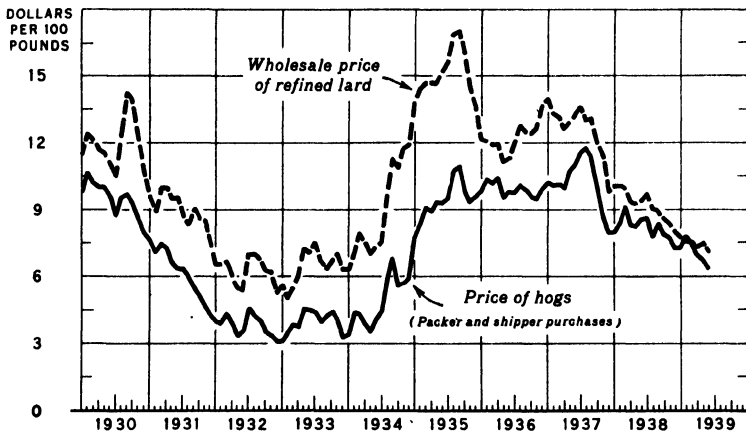


FIG. 163. Prices of hogs and lard at Chicago. In recent years the wholesale price of refined lard has not been much higher than the price of hogs. The price of pork has declined less than the price of lard. (U.S.D.A., Bur. of Agri. Economics.)

quantities if firm acceptable carcasses are to be produced. Soy beans can be used as a part of the protein supplement; under ordinary conditions, if limited to 10 per cent or less of the ration for pigs starting on the beans at 100 pounds, good-quality firm carcasses will be produced.

Soft pork is of no lower nutritive value than firm pork, and it is of acceptable taste and flavor. Since soft carcasses do not firm in the cooler the cuts are soft, flabby, and oily. As a consequence the appearance of soft pork cuts makes them less acceptable to the trade. Also the lard is inferior because of its low melting point. Pork cuts like bacon that are soft are diffi-

cult to slice. The fat of soft and oily pork has more than the usual amount of unsaturated fatty acids which have relatively low melting points. Such fat and oils are less resistant to rancidity.

Pork and Lard Consumption

For a period (about 1899–1933) the total production and consumption of pork increased at about the same rate as human population. Per capita consumption since then has fluctuated

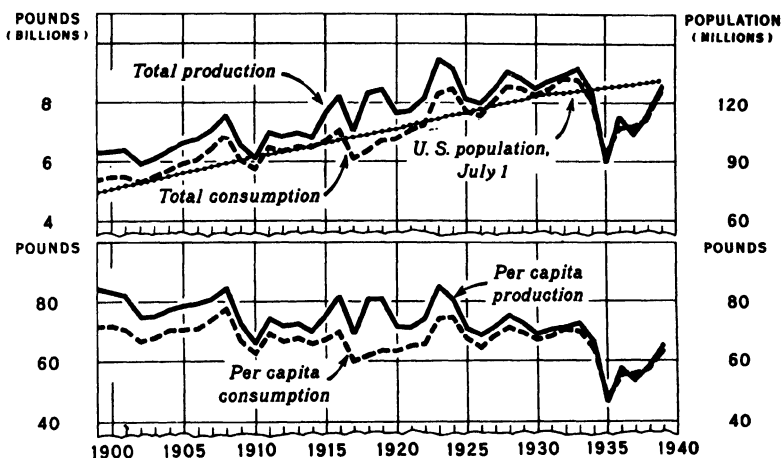


FIG. 164. Pork production and consumption and U. S. population. Our population has increased and pork produced per person has decreased, but consumption has remained up because of decreased exports. (U.S.D.A., Bur. of Agri. Economics.)

around a comparatively stable level, but it appears to show a slight downward trend. Production was low following the drought years of 1934 and 1936. In fact, some pork was imported in the years of short supplies. (See Figure 164.)

Exports have varied markedly from time to time and this causes changes in our supply available for home consumption. However, the production is a greater factor in the amount for domestic consumption. Since 1920 the exports of pork have ranged 838 million pounds from a greatest to least exported, while production ranged 3529 million pounds.

The total and per capita production and consumption of lard

has varied in about the same way as pork. In spite of the competition from lard substitutes lard consumption has remained at a fairly high level.

The yearly per capita consumption of pork excluding lard from 1899 to 1939 inclusive, ranged from a high of 77.4 pounds in 1908 to a low of 48.5 pounds in 1935; the average yearly consumption for the period was 66.77 pounds.

Lard consumption has also fluctuated markedly for the same period, the high being 14.5 pounds per capita in 1924 and 1925 and the low 9.6 pounds in 1935. The average yearly consumption was 12.28 pounds.

There is some variation in the consumption of pork and lard by sections. The per capita consumption is the greatest in the southern states, somewhat above average in the north central states, and considerably below average in the western and north-eastern states. The consumption in rural sections is more than in urban sections.

There are several peoples of the world who do not consume pork, namely the Jews, Egyptians, Hindus, and Mohammedans.

Pork and Lard Exports

Exports of pork and lard tend to be high when we have a heavy production, and when there is a shortage of slaughter hogs the exports are low. Production in Europe and also import restrictions of various countries have affected the export of pork and lard.

It will be noted in the chart, Figure 165, that during the First World War pork exports were at a large volume. This was curtailed with the expansion of hog production in Europe. However our exports of lard persisted for a longer time than pork. This situation affected our hog types for we exported more lard than pork, relatively. When our exports practically ceased we then had a hog production not too well suited for our needs. Our domestic demand called for less lard relatively than when the export demand was in the picture.

BY-PRODUCTS FROM HOG SLAUGHTER

Relatively the by-products other than lard from hog slaughter are of small value as compared with the returns from the pork

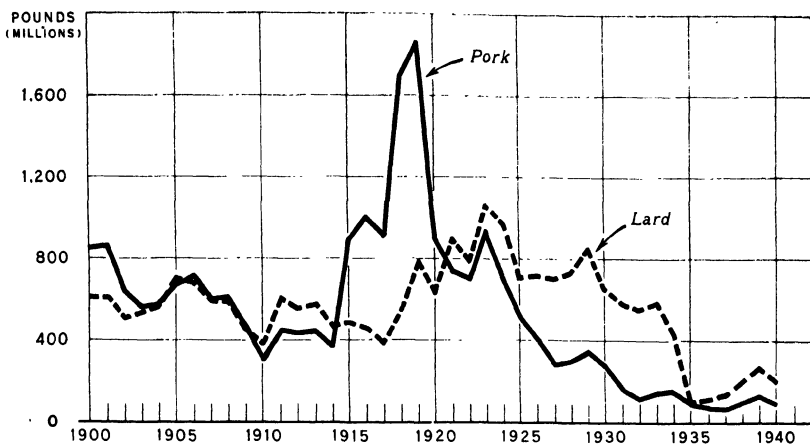


FIG. 165. Exports of pork and lard. Our exports of pork and lard were heavy following the First World War. Then hog production was expanded in Europe and restrictions were imposed on hog products by many countries. Restricted production after 1934 and 1936 drought caused a further reduction in exports. (U.S.D.A., Bur. of Agri. Economics.)



FIG. 166. Making pork sausage. (Swift and Co.)

and lard, also as compared with other slaughter animals. On the basis of the average dollar the meat packer receives from the sale of the cuts of pork, lard, and by-products, the income is divided approximately as follows.¹

96.3 per cent from the meat and lard.

2.2 per cent from the edible by-product.

1.5 per cent from the inedible by-product.

This is on the basis of June 1937 prices.

A hog weighing 250 pounds would yield 3.5 per cent or $8\frac{3}{4}$ pounds of the live weight of edible by-products. These would be liver, kidney, casings, giblet, gullet and weasand meat, etc., which are known as "fancy meats." Such a hog would yield 2.5 per cent or $6\frac{1}{4}$ pounds of inedible by-products which would be grease, hair, blood, tankage, etc.

Disposition of Hog By-Products by a Large Packing Company

The principal by-products from the slaughter of hogs, those finished by the packing plant and those manufactured after leaving the packing company, are listed by Swift and Company on pages 435-436.

¹ Swift and Co., *Agricultural Research Bull.* 19, May 1940.

<i>Principal By-Products Obtained From a Hog</i>		<i>Finished By-Products Prepared by Swift & Company</i>	<i>By-Products Manu- factured After Leaving Swift & Company</i>
Skin	Bristles		Brushes
	Hair		Felting Upholstering Plaster retardant Rug pads Insulation
	Pork skin	{ Glue Gelatin	{ Leather goods, such as safety razor strops, belts, fish bait
Fats	Leaf fat	{ Lard (neutral) Sold as such Lard	{ Salves Cosmetics
	Edible killing fats	Tankage—Animal feed	
	Cutting fats	{ Grease	{ Fatty acid Metal polish Cosmetics
	Miscellaneous inedible fats such as unclean fats, floor scrapings, teeth, nasals, ear canals, eyebrows, condemned car- casses or parts, bruises, catch basin skimmings	{ Soap—Glycerine (Flexible glue)	{ Red oil (wool finisher) Stearic acid Candle stock Tar { Roofing and Paving Purposes
		{ Lard oil	{ Medicine Explosives Moisture retainer Moulds Lubricants Burning oil Tanning Cleaning emulsions Stearic acid Red oil Candle stock Cosmetics Soap
		{ Grease stearine	
		Tankage—Animal feed	
		Sausage containers	
		Chitterlings	
	Stomach	Sausage containers	{ Pepsin
	Bladder	Tripe	
		Grease (See grease under "Fats")	
		Tankage—Animal feed	
		Fertilizer	
Blood		Blood meal—Animal feed	
		Sausage	
Gall			Pharmaceutical Uses
Glands	Pancreas		Pharmaceutical Uses
	Ovaries		
	Thyroid		
	Pituitary Suprarenal		

<i>Principal By-Products Obtained From a Hog</i>		<i>Finished By-Products Prepared by Swift & Company</i>	<i>By-Products Manu- factured After Leaving Swift & Company</i>
Head	Tongue	{ Sausage Potted tongue Canned pickled tongue	
	Ears	{ Sausage Sold as such	
	Lips	{ Sausage Sold as such	
	Snout	{ Sausage Sold as such	
	Cheek and Head meat	Sausage	
	Brain	{ Sold as such Canned Lard Glue	
	Bones	{ Steam bone Tankage { Fertilizer Animal feeds Grease (See grease under "Fats") Lard Sold as such Pickled and dry salt Grease (See grease under "Fats") Glue Tankage—Animal feed	
	Feet	{ Sold as such Pickled and dry salt Grease (See grease under "Fats") Glue Tankage—Animal feed	
	Tail	Sold as such	
	Heart	{ Sold as such Sausage Sold as such	
	Misc'l.	{ Liver Sausage	{ Liver Extract Pharmaceutics
	Lungs	Tankage—Animal feed	
	Kidneys	Sold as such	
	Giblet, gullet and Weasand meat	Sausage	
	Melt	Sold as such	

Chapter 27

SWINE FEEDING AND MANAGEMENT

SWINE FEEDING

Swine are more economical converters of feeds into grains than the other slaughter animals. The explanation for this efficiency lies in the fact that hogs grow faster in proportion to their size than the other farm animals. A larger proportion of the feed consumed is therefore used for body tissue (meat and fat). A pig has a simple stomach and a limited capacity for feed; but, size considered, it consumes a large amount of feed.

Peculiarities of Swine Feeding

The hog is likewise distinctive in that the feeds used are largely concentrates. Roughage, or pasture, usually represents but a small portion of the nutrient intake. Because of this peculiarity, the rations are relatively simpler than those of other farm animals. On the other hand, since the ration may be without roughage or forage, nutritional deficiencies are not uncommon, since these classes of feeds are often the safety factors in protein, mineral, and vitamin needs. For example, the nutritional properties of good forage will overcome many of the shortcomings of a straight grain ration.

Swine feeding is unique in another respect, and that is that corn is so widely used. This is not because other feed grains are unsatisfactory, but rather because corn so often has the advantage in economy of production. The common custom of restricting feed consumption to one grain, especially corn, is responsible for the rather widespread inadequacy of swine rations. Deficiencies are far more prevalent in rations for swine than for other livestock. Proper supplementation of the basal feed is often overlooked. Cost of feed is a very important item in the economy of hog raising, as feed costs will constitute 75 to 85 per cent of the total cost of producing a marketable pig.

More particularly, the chief concern is the relationship between feed prices and hog prices, or the hog-feed price ratio.

Swine feeders in the main have not paid much attention to feed requirements and feeding standards. This is due to the rapidly changing requirements of swine, in growth and fattening, and the widespread use of group feeding rather than feeding individuals separately. Self-feeding has also detracted from interest in the use of feeding standards. The actual feed requirements of swine for protein and energy have not been studied with the completeness that marked such investigations with cattle and sheep.

Composition of Swine at Different Weights

The rapid change in actual needs is indicated by the marked change which takes place in the composition of the pig as it grows and fattens. In the tabulation that follows there are included data on average composition of swine based upon analysis at the Agricultural Research Center, U. S. Department of Agriculture, Beltsville, Maryland.¹

BODY COMPOSITION OF SWINE

Condition of Fatness	Weight at Slaughter, Pounds	Body Substance, Pounds	Components of Body Substance, Per cent			
			Water	Protein	Fat	Ash
Thin	106	100	56.3	14.9	25.8	3.1
Moderately fat	162	154	49.2	13.7	34.2	2.9
Fat	219	210	44.3	12.6	40.6	2.5
Very fat	230	219	41.4	10.5	45.9	2.3
Extremely fat	343	327	37.7	10.8	49.5	2.1

It should be pointed out that wide ranges in composition would be prevalent at the weights given, and that such factors as age, type, and method of feeding would be related to composition as well as to weight and fatness. Relatively, that is, in comparison with other slaughter animals, the mineral or ash content is low and the fat content is high. It will be observed by an inspection of the tabulated data that heavier pigs are fatter and have less water, protein, and ash than lighter pigs. It is also quite apparent that the ration for the older pig is

¹ *Yearbook of Agriculture, 1939*, U.S.D.A., p. 708.

therefore used more for fat forming. Since much of the fat is made from the feed carbohydrates in the pig and 2.25 pounds of the latter equals 1 pound of fat in energy value, it is evident that fat gains require more feed than protein gains.

Since it is difficult to divide maintenance from production, most of the feeding standards for swine combine the economic maintenance with production. For example, a 250-pound bred gilt makes a substantial storage in the fetal growth which is not easily separated from maintenance needs. In general, recommendations in feeding standards are sufficiently great to meet all the usual nutrient needs. In maintenance studies it has been found that the needs are directly proportional to the weight. For example, 1 pound per day of such feed as yellow corn, middlings, and tankage per 100 pounds will maintain 225-pound pigs; but for 60-pound pigs the requirement is 1.5 pounds per 100 pounds live weight. It has also been found that values for a feed in protein or energy vary with the type of body function, that is, growth, fattening, pregnancy, and lactation. In other words, a feed of a given energy value usually has a higher energy value for maintenance than for fattening.

The protein requirement under usual swine feeding methods is of far greater concern than the energy needs. Most farm feeds are inadequate in protein for swine and supplements are needed for best results; of the proteins in grains about 75 per cent are digestible and of this only about one-half is of the kind needed for tissue building in the body. Rations are often lacking in amount of protein needed and also may be inferior in protein-building capacity or biological value.

Nutrient Requirements of Swine

In the Morrison Feeding Standard, the following is suggested as an adequate allowance for the various classes of swine. These are selected as representative of the needs only, not a complete statement of the requirements for all weights and conditions.

A comparison of the requirements given in the Morrison Feeding Standard will bring out the difference in needs for different classes of swine. A 300-pound individual is included in all of these standards and although it is not the average of each class it will serve for a basis of comparison.

DAILY REQUIREMENT PER HEAD, MORRISON FEEDING STANDARD

<i>Class</i>	<i>Weight</i>	<i>Dry Matter, Pounds</i>	<i>Digestible Protein, Pounds</i>	<i>Total Digestible, Pounds</i>	<i>Nutritive Ratio, 1 to</i>	<i>Net Energy, Therms</i>
Growing and Fattening Pigs	300	7.1-8.4	0.85-0.95	6.4-7.6	6.6-7.0	5.9-7.0
Wintering Pregnant Gilts	300	4.4-5.4	0.57-0.63	4.0-4.8	6.0-7.0	3.6-4.4
Wintering Pregnant Older Sows	300	3.7-4.5	0.43-0.49	3.2-4.1	6.5-7.5	2.9-3.7
Brood Sows Nursing Pigs	300	8.9-10.9	1.16-1.23	8.1-9.5	6.0-7.0	7.5-8.8

It will be noted that the brood sow nursing pigs class is more heavily fed than the other classes listed; also, the nutritive ratio is somewhat narrower.

Growth and Fattening Needs

The young pig, for optimum growth, needs a ration with a high percentage of protein. Likewise, to be adequate, all the nu-



FIG. 167. Purebred Poland-China gilts at the Buck and Doe Run Valley Farms, Coatesville, Pa.

tritive essentials must be provided. It is obvious that ample energy is needed for growth and maintenance.

As the pig becomes older and fatter, the protein intake may be lessened in proportion to the energy. For example, for a 50- to

100-pound pig the level of protein in the ration would be about 15 to 18 per cent, while for the 150- to 200-pound pig 12 to 13 per cent is satisfactory. The pig, if permitted free choice of feeds, will shift in proportions of feeds consumed to meet this changing requirement.

Feeding standards have been of some help to swine feeders, especially in checking feeding operations; however, their use has been less extensive than in other livestock.

In general, swine feeding has been resolved into the evaluation of various feed combinations and the measurement of result in terms of rate of gain and the feed required for a unit of gain.

Reproductive and Lactation Requirements

As swine reproduce at a comparatively early age, reproduction and lactation often overlap with growth. The needs are much the same, that is, the ration should be relatively narrow in the nutritive ratio, ample in all of the essentials, and sufficient in amount. The pregnancy ration needs to be ample in amount, for during this period sows build up for subsequent lactation. Even though sows be self-fed during lactation, if lactation is heavy, weight is not maintained.

Mineral and Vitamin Needs

The incompleteness of corn as the entire feed for swine was early recognized. Corn lacks some of the essentials for growth, that is, some of the indispensable amino acids, minerals, and vitamins. This emphasized the need for nutrients other than quantity of protein and energy materials, and also pointed out the fallacy of putting great reliance on only the two groups of nutrients.

The mineral needs are extensive in quality but in quantity quite small, as is the case with vitamins and similar essentials. This is an expanding field and beyond the province of this text. It is quite evident that these essentials must be supplied in the ration — that which is fed, and also what is picked up from the lot, pasture, or range. Since only small amounts of these newly discovered essentials, nicotinic acid, for example, are needed, most rations otherwise well balanced and with some variety are comparatively complete nutritionally.

Practices in the Feeding of Swine

THE BREEDING HERD

The sow breeding herd that is producing two litters per year is fed for production almost all the year. The period of economic maintenance is quite short, since a prebreeding period of feeding or flushing is customary. The effectiveness of flushing has been questioned, especially if the sows are not permitted to reach a low plane of nutrition. Feeding during pregnancy overshadows flushing because proper feeding then reduces prenatal deaths, which is more important than ova shed.

In summer the breeding herd is kept on pasture, which lowers the cost and has many other beneficial effects in its favor. Enough concentrated feed is needed to permit the maintaining of fairly good condition. Concentrate feeding is stepped up as the time for breeding nears. Following breeding, the ration effect may be quite marked on the litter size and vitality of the pigs. Good feeding of an adequate ration is to be stressed, especially during the latter part of the gestation period. If this period is in the winter, as it is with spring-farrowed pigs, good legume hay should be a part of the ration. In the summer good pasture is advised.

At farrowing, feeding with caution is indicated, and when the sow has returned to normalcy, heavy feeding is needed to induce milk flow and maintain condition. After weaning there is a short recovery period when the sows should be on pasture or in the fields.

THE FEEDING OF PIG CROPS

There are two general methods used in feeding of pig crops: (1) the full feeding method in which pigs are heavily fed from weaning time until they are marketed, and (2) the limited feeding plan in which a limited amount of feed is used. The latter plan is often modified by finally finishing the pigs by the full feeding plan.

In general, the limited feeding method is used on late-farrowed spring pigs in order to get the maximum use of forage crop and to finish them on the new corn crop.

The full feeding plan is used for early-farrowed spring pigs,

and generally for fall pigs. Where the two litter a year plan is carried out, such full feeding is desirable to prevent overlapping of crops of pigs.

In choosing a feeding plan suitable to a situation, one must consider the equipment, feed, labor, and pasture available. The production should be timed to the market, that is, the crop



FIG. 168. Market pigs of the right type. Grand champion carload at the 1940 International Livestock Exposition. Shown by Howard Charlot, Blair, Nebr.

should be fed out in such a manner as to sell when hog prices are not seasonally low.

Effect of Feeding on Carcass Composition

Within limits it is possible to affect the composition of the carcass of the pig. The inherited characteristics set the pattern, but an important factor in the fulfillment of the pattern is the nutrition.

Pigs fed liberal rations will have carcasses with more fat and less lean than pigs fed scanty rations. The relation between carcass composition and method of feeding is illustrated by the data given on page 444.

The pigs were fed to weigh 200 pounds. The weight of the pigs fed high for the first 16 weeks was 100 pounds. Pigs fed low weighed but 50 pounds at 16 weeks of age.

For the leanest carcasses pigs should be fed slowly throughout; however this may not be practical or economical. The fattest carcasses were produced on the plan of feeding slowly at first and then rapidly. This appears to be the least practical of the methods used from the viewpoint of both the raiser and the

RESULTS OF DIFFERENCES IN RATE OF FEEDING ON
CARCASS COMPOSITION¹

<i>Method of Feeding or Plane of Nutrition</i>	<i>Per cent of Carcass Weight</i>				
	<i>Fat</i>	<i>Muscle</i>	<i>Bone</i>	<i>Skin</i>	<i>Tendon Glands</i>
High-High	38.3	40.3	11.0	5.3	5.1
High-Low	33.4	44.9	11.2	5.4	5.1
Low-High	44.1	36.3	9.7	4.8	5.1
Low-Low	27.5	49.1	12.4	5.8	5.2

processor. Liberal feeding throughout produces more fat than using limited feeding for the latter part of the feeding period. Self-feeding is a very practical method, and also an economical one. It may be worth while to deviate from this practice, but this would depend upon the prices paid for lean hogs and fat hogs and their production costs.

Trials such as the above have been conducted more extensively on hogs for Wiltshires or the bacon type. It has also been found that with such hogs additional protein in the ration above the minimum requirement will not increase the lean.

SWINE MANAGEMENT

Proper management is essential for success in swine raising. There are critical periods in the handling of the breeding herd, and careful attention during breeding, farrowing, and raising the pigs to weaning is necessary for a productive herd. The mortality of the young is much higher with swine than other kinds of livestock, and normally not more than 60 per cent of the pigs farrowed are raised to marketable weights.

Sanitation is also a troublesome problem in swine raising. Since hogs live close to the ground, they are subject to many filth-borne parasites and diseases. The statement that "hog health makes wealth" is literally true since unhealthy hogs are generally unprofitable. Only by avoiding disease and parasitic losses by skillful handling and treatment is it possible to have a highly profitable swine herd. The efficient management of the breeding herd plus good feeding is imperative for low production

¹ *Yearbook, 1939, p. 474.* U.S.D.A.

costs. Up until weaning time there is but little difference in the cost of raising a large litter and one of average size. Therefore, we want sows that farrow and raise large litters, but in order to be productive the sow herd must be well fed and cared for.

Hogs are kept on a farm or ranch to convert some of the home-raised feeds into profitable gains. The manager must see to it that all needs are provided so that the hogs will serve this purpose and also so that a profit is realized from the enterprise.

The various essential factors which the manager must be mindful of are:

1. The usable supply of feed. Since hogs use mainly concentrated feeds, an ample supply should be available. The supply of basal feed like corn usually is sufficient, but for efficiency there is need for protein-rich feeds, mineral supplements, suitable forage and roughage, and perhaps vitamin supplements. If the home supply of a feed like corn is not properly supplemented, the results will not be satisfactory.

In keeping down production costs the swine man first examines the feed costs, since these comprise over three-quarters of total costs.

2. The equipment needs. The equipment needed depends upon the weather conditions and the general plan of hog raising. Ample farrowing quarters are needed for early farrowing such as is practiced in the two-litter-a-year plan. Also, fall pigs require some protection in the winter time. Movable houses can be used quite satisfactorily for some situations, but a central hog house has many advantages. Suitable shelter for young pigs reduces the pig losses.

Other than the house equipment there is necessity for many other equipment items which are time savers. Self-feeders, feeding floors, hog waterers, fencing, troughs, hurdles, sun shades are but a few of the many pieces of equipment that may be found on a well-managed hog farm. The size of the hog raising enterprise on the farm will determine the need for the various items.

Many hog raising farms have a combination of housing that is both a central house and movable house. Farrowing is carried out in the central house, and then movable houses permit decentralization for the utilization of clean ground pastures.

It has been found that dividing the hogs and pigs into small groups is advantageous. This is more easily accomplished with movable houses and many lots. Also, the movable housing permits greater range and exercising. However, other equipment is required when the hogs are spread out, as feeding and watering is not centralized.

3. The labor involved. At certain times during the year the swine herd requires a considerable amount of labor. With a crop of pigs well started the labor needed may be quite low if the equipment is satisfactory. Hog raising should be arranged so that the work is integrated with the other farm work. Spring farrowing, then, should not conflict with the time of planting the crops. Actually the labor cost is one of the smaller items, usually running about 5 per cent of the total cost.

4. The market outlook. The hog enterprise is very flexible, and producers attempt to take advantage of the relative profitability of swine raising by altering the size of the pig crops. The limiting factor is usually the equipment for handling the hogs. The capacity of the equipment is to be considered at breeding time, yet it is impossible to foretell the size of the litters and the number that will be raised. To some extent the production may be adjusted in accordance with the hog price outlook, and the outlook for other salable products, production of which may be expanded or contracted. In laying plans for hog raising the seasonal variation in hog prices and the cost of production are also to be considered. When a time of marketing is decided upon, the time of breeding is set so that with the method of feeding used the pigs are finished properly at the time of marketing. A good manager plans to have the market pigs ready to sell when the hog price is high, or if he sells on a low market his cost of production should be low.

5. Keeping records. Carefully kept records assist the manager in making an analytical study of the various phases of swine production. For the usual swine herd kept for market hog production, a breeding record, a farrowing record, a litter identification, and a financial record will serve most of the needs. With a purebred herd more extensive records are essential.

6. Disease and parasites. There are several rather common diseases which may cause very heavy losses in swine herds

unless proper preventive measures are followed. We can immunize against some diseases, for example, hog cholera, while strict sanitary measures are essential for control of others. There are also several parasites of swine which may cause heavy losses if not controlled. The common intestinal worm can be controlled by the McLean County or clean ground system. Until this method was developed, unthrifty herds were far more prevalent. Skillful management of the herd involves the avoiding of diseases and parasitic losses by the time-tried control methods.

There are many other services which the manager must perform or have done to maintain a productive herd. Attention to proper feeding, selection, and breeding are just a part of the job. For good results an ample water supply and comfortable surroundings are imperative.

Many other tasks such as castrating and weaning must be performed. Although hog raising may be under some circumstances quite automatic, on the usual farm close attention and supervision are necessary.

Chapter 28

SWINE BREEDING

The breeding of swine has been investigated somewhat more completely than that of other farm animals. The rapid reproductive rate permits the use of larger numbers in a short period of time. The effect of inbreeding, for example, has been studied extensively in swine, whereas there is little information available on the effect of this practice in cattle, sheep, or horses.

The subject of swine breeding is discussed under the following headings: the reproductive process, the breeds, breeding systems, and breeding stock selection.

The Reproductive Process

REPRODUCTION

Gilts become sexually mature when they are from six to eight months of age if they have been liberally fed. Well-grown gilts may come in heat at four months of age. There is some seasonality of breeding, but litters are produced in all months. There appears to be an intensification of the heat periods in the fall, yet sows come in heat quite regularly except when they are suckling pigs. The number of farrowings reaches its peak in the spring and in the fall. The normal period from one heat period to the next is about 21 days. The period of oestrus will range from 40 to 65 hours, it being shorter in gilts than older sows.

Ovulation occurs in the latter half of the heat period. It appears from investigations that sows can be bred too early or too late in the heat period to have the maximum litter size. A sow will shed about 18 ova. Some of these are not fertilized, and many of the fetuses degenerate during the gestation period.

State of nutrition will affect the oestrous cycle, and if the plane of nutrition has been low the number of ova shed may be below

normal. Flushing is practiced, with beneficial results in some cases. It is questionable if increased feeding at breeding would affect litter size if nearly adequate nutrition is provided. Certainly the feeding during gestation overshadows flushing, for it can very definitely affect the litter size and the strength of the new-born pigs.

The average length of the gestation period in swine is 114.5 days with a standard deviation of 2.2 days. The birth weight

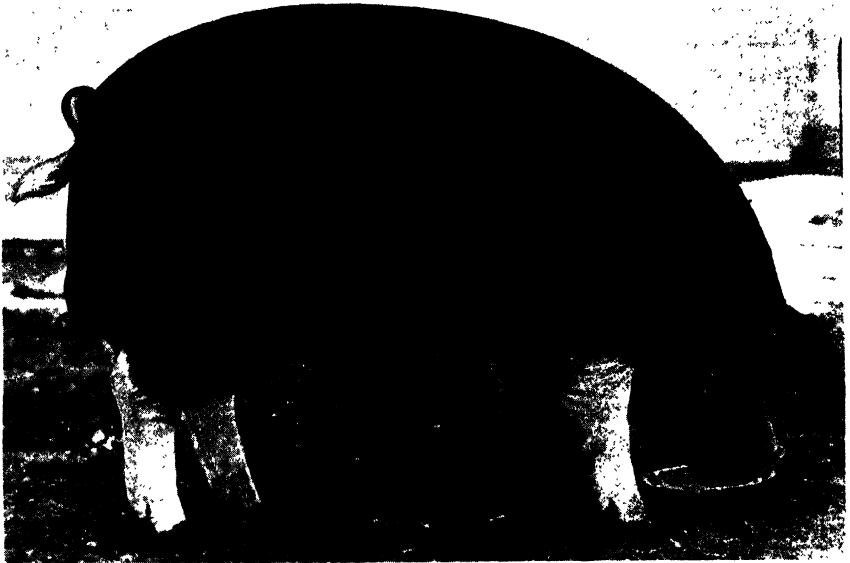


FIG. 169. A grand champion Poland-China boar. Owned by Clark Huber, Irvington, Nebr.

for pigs is about 2.5 pounds, and the males slightly outweigh the females. There is quite a range in the birth weights of pigs. The larger pigs are the strongest and most likely to survive. Feeding during pregnancy affects the birth weight of the pigs. Also, the number of pigs in the litter, the age of the sow, breed, crossbreeding and inbreeding are factors affecting the birth weight.

The boar matures sexually at six to seven months of age. Many boar pigs are used for breeding and their first crop of pigs is farrowed when the boar is about a year old. Farmers prefer

to use a younger boar because of the ease in handling and the smaller amount of feed needed. It is quite common to castrate the boar after the sows have been settled and sell him as a stag. Since the average size herd of hogs is smaller than that of cattle or sheep, the ratio of boars to sows is lower than the ratio between breeding males and females in cattle or sheep.

LITTER SIZE

Under normal conditions there is a great range in the litter size. Most herds average about nine pigs per litter, but within



FIG. 170. A grand champion Poland-China sow, Model Ann. Owned by Oscar W. Anderson, Leland, Ill.

a herd there may be a great range. Some of the factors which are related to litter size are age of the sow, the service boar, nutrition, type, and individuality of the sow, and time of mating.

Older sows have larger litters than gilts up to about four years of age. If the sire of the litter is bordering on infertility, this condition may affect litter size. Ample feeding on an adequate ration will produce larger litters than feeding rations inadequate in quality or amounts. Breed and type are also related to prolificacy.

The number of pigs raised per sow farrowing has shown a slight upward tendency in the last two decades, during which time reports from pig crop surveys have been available. The number of pigs raised per sow per litter is slightly above 6.0. Slightly larger litters are raised in the corn belt than outside of the corn belt. The fall litters are a little larger than the spring litters.

TIME OF FARROWING

April is the month of heaviest farrowing; in fact, about one-half of the pigs raised are farrowed in March, April, and May. Heavy farrowing also takes place in September and October, but less than one-fifth of the entire year's crop is farrowed in those months. There seems to be an increase in the fall farrowings which has been coincidental with the greater use of the two litter a year plan.

ARTIFICIAL INSEMINATION WITH SWINE

In general, artificial insemination has been only mildly successful in swine. Usually only small litters are produced when this method is used. Although the boar produces a greater volume of semen than do other farm animals, the ejaculate from a single service can inseminate very few sows. Also, the sperm cannot be kept fertile as long as sperm from other common farm animals.

*Swine Breeds*¹

Several breeds of hogs were brought to this country, and several American breeds were developed to meet our needs. The Berkshire, Yorkshire, and Tamworth of the imported breeds have been continued, but the other numerous breeds were developed in this country. Hogs from England, Europe, and Africa were used for the foundation of our present-day breeds. No direct shipments of breeding hogs from China are noted in breed histories, yet China hogs were brought here from England and used in some of our breeds. Such breeds as the Duroc, Poland China, Chester White, Hampshire, and Spotted Poland China were all formed in this country.

¹ For a complete discussion of swine breeds, refer to the texts listed in the Appendix.

TYPES WITHIN A BREED

As previously indicated, we have types within a breed. For example, we recognize by form or general conformation, small type and large type and also those in between. The intermediate is common and popular today. The small types were popular in the early part of the century. This type proved uneconomical on the farms because of the slow gains and low prolificacy. They were also unsuited for farm feed lot and forage crop utiliza-



FIG. 171. A Duroc boar of the right type. Grand Duke, first prize junior yearling and reserve grand champion boar at the 1940 Illinois State Fair.

tion. They produced pork cuts that were small, and yielded large quantities of lard.

The extreme rangy kind which followed the small type was also not the best for the packer or the producer. These were slow maturing, lacked finish at desirable marketable weights, had an excess of bone and too large pork cuts. Generally, they were too large for the usual farm farrowing house equipment.

Since neither the large nor the small suited the producer or the packer, the tendency of late has been to stay with the inter-

mediate type. This kind has the greatest adaptability, is unexcelled in economy of production and highly acceptable to the consumer. Some changes in type will occur, but with closer cooperation between packers and producers they will perhaps be less violent than previously.

Some breeds have switched more in type than others, and breeders within a breed are not wholly in agreement as to the ideal type.

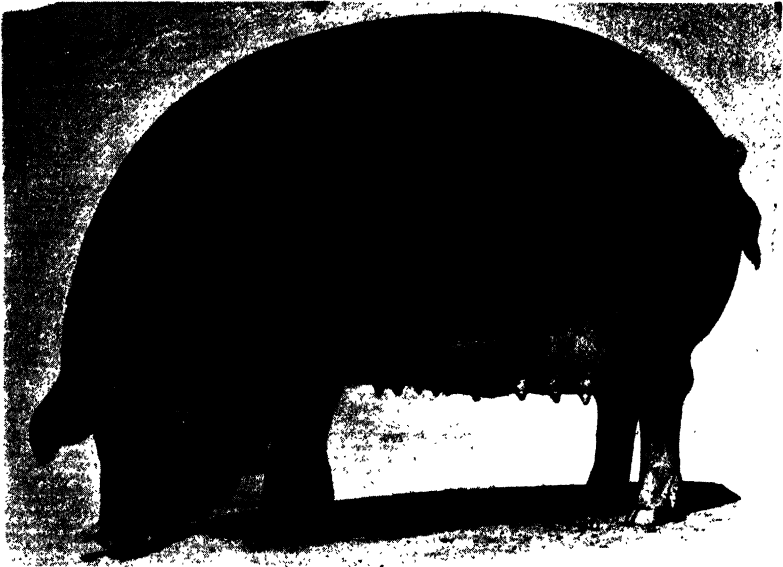


FIG. 172. A Duroc sow of the approved type. A National Swine Show grand champion.

CHOOSING A BREED

There is no superior breed for all conditions. * One breed may be suited to certain situations because of their peculiar characteristics. Yet, for the most part these distinctive external characteristics are such features as color or shape of head and ears, which are not highly related to economy of production. The response of the various breeds may be much the same under similar circumstances. Some breeds are larger or more prolific or better grazers than others, and these are features that affect production. Local market demand and suitability to

local conditions, along with economy of production, should form the basis for selection.

Breeds change in their popularity; yet, some breeds have less fluctuation in popularity than others.

DIFFERENCES IN THE SIZE OF BREEDS

Based on the weights of prize-winning animals, breeding swine at the National Swine Show may be classified as to size. The Poland China and the Duroc appear to be the largest of the swine breeds. The Yorkshire, Hampshire, and Tamworth are



FIG. 173. An excellent Spotted Poland-China boar, Gunfire, a prominent show ring winner. Shown by John A. Wilt, Hillsboro, Ind.

in the lighter weight group, while the Chester White, Spotted Poland China, and Berkshire are much the same in weight and in between the two previous groups. The breeds heavier as pigs usually retain that advantage in all the age classes. Boars generally outweigh the sows.

INTERBREED COMPETITION

At the International Live Stock Exposition, Berkshires, Poland Chinas, Chester Whites, and Hampshires have ranked high in interbreed competition. Of these the Hampshire excels in the carload class while the Berkshire excels in the carcass classes.

Breeding Systems

Since swine reproduce rapidly, considerable experimental evidence is available on the different breeding systems. Likewise, breeders have gone further in the trying out of different breeding systems.

GRADING UP

This method has long been used by hog raisers for the improvement of native or scrub stock. A purebred boar is used on the scrub and grades, and in three or four generations the high grades are practically equal to purebreds in market value. Since this process has been going on for years, very low-grade or scrub sows are now rarely used for breeding. Swine retrogress if they escape from domestication and forage for their living, such being the case with the razor-back hog. The amount of improvement possible from the use of a purebred boar on low-grade and scrub hogs of nondescript breeding is shown by some Alabama experiments.¹

	<i>Scrubs</i>	<i>50 Per Cent Grades</i>	<i>75 Per Cent Grades</i>	<i>87.5 Per Cent Grades</i>
Days to reach 200 pounds	244	201	201	187
Daily gain, pounds	0.95	1.18	1.19	1.26
Feed for 100 pounds gain, pounds	465	403	388	382
Feed cost for 100 pounds gain	\$9.31	\$8.07	\$7.75	\$7.63

These data clearly indicate that the pure breeding causes an improvement in the rate of gain and feed for gain when used with scrubs. It will also be noted that the improvement is less marked as the breeding of the females approaches that of the purebreds.

CROSSBREEDING

This practice has proved its worth in experimental trials and in the hands of swine raisers. We do not know how all crosses will respond, and we have found that some crosses give better results than others.

¹ J. C. Grimes, W. E. Sewell, and W. C. Taylor, "Grading Up Hogs," *Bull.* 234. Ala. Polytechnic Institute, November 1930.

What might be expected in crossbreeding of swine is summarized in an Iowa bulletin.¹

The following statements concern the average results. There was much individual variability from litter to litter and from pig to pig even in the same litter, both among crossbreds and among purebreds.

The results obtained at the Iowa Agricultural Experiment

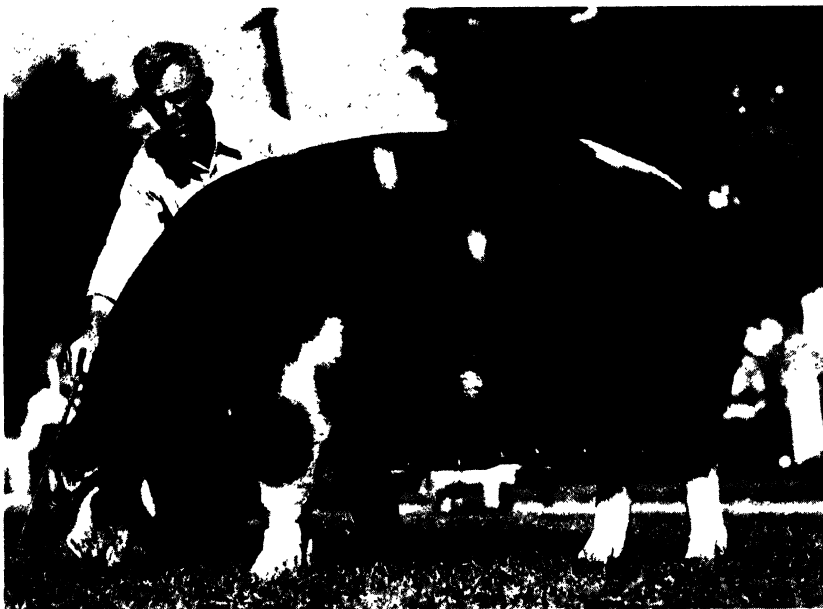


FIG. 174. An outstanding Spotted Poland-China sow, Limit Sunshine Girl, a National Swine Show grand champion. Shown by John A. Wilt, Hillsboro, Ind.

Station involve 1015 pigs farrowed in 108 litters. These data include the Landrace-Poland China crosses as well as those made with the Duroc Jersey, Poland China, and Yorkshire breeds.

The percentage of still-born pigs was smaller among the crossbreds than among the purebreds.

Crossbred pigs were somewhat more vigorous at birth than purebreds, as shown by their ability to survive until weaning age.

¹ J. L. Lush *et al.*, "Crossbreeding Hogs for Pork Production," *Bull.* 380, Iowa State College Agr. Exp. Sta., June 1939.

Crossbred pigs average about three or four pounds heavier at weaning time than purebreds. The weaning weight of crossbred litters averaged more than for comparable purebred litters, partly because of the larger size of the pigs in the crossbred litters and partly because the crossbred litters on the average contained slightly more pigs at weaning time.

Crossbred pigs gained about 0.09 to 0.12 pounds per day more



FIG. 175. A Hampshire boar of the correct type, Silver Clansman, All-American Hampshire aged boar, 1939. Owned by Cesor Farms, Farmington, Mich.

while in the feed lot than purebreds, which means a saving of about 10 days to 2 weeks time in getting them to a weight of 225 pounds.

Crossbreds reached a weight of 225 pounds on 25 to 30 pounds less feed than was required by purebreds.

The crossbred sows observed in this study proved to be efficient pig producers, whether mated back to a boar of one of the parent breeds or to a boar of a third breed. When sired by a purebred boar, the pigs from the crossbred sows, either back-

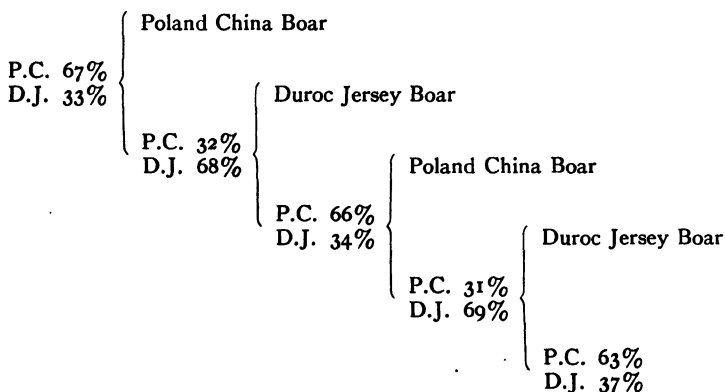
cross or three-breed cross, compared favorably with the first-cross pigs.

There is some reason to suppose that breeds differ in their response to crossing and also that families or strains within breeds differ.

Crossbreeding can be continued as a steady policy only by going to purebred herds for the boars needed for replacement. Crossbred animals have a lower value than purebreds as transmitters of inheritance. Crossbred sows may be used successfully for breeding if the boar is a purebred. In this way the hybrid vigor of the crossbred dam in nursing and rearing pigs may express itself enough to more than compensate for her lower value as a transmitter of inheritance. No such offset for his lowered transmitting value could exist in the case of a crossbred boar. Planless and unsystematic crossing may quickly result in a mongrel herd from which the owner will get neither profit nor pride of ownership.

USING CROSSBRED SOWS

Crossbred sows are generally efficient pig producers. They may be mated back to a boar of the parent breeds, which is backcrossing. If mated to a boar of another breed, the practice is called three-way crossing. "Criss-crossing" is the term applied to backcrossing carried past the first generation, in which series of the parent breeds are alternated on the crossbred sons. It is illustrated in pedigree form in the following manner.



INBREEDING IN SWINE

With inbreeding in swine there is a reduction of the vigor and the productivity. When practiced with rigid selection, the loss of vigor may be but very slight. This system was used rather widely in the formation of our swine breeds. By means of inbreeding recessive characters can be eliminated and the inbreds may be pure for their characters.

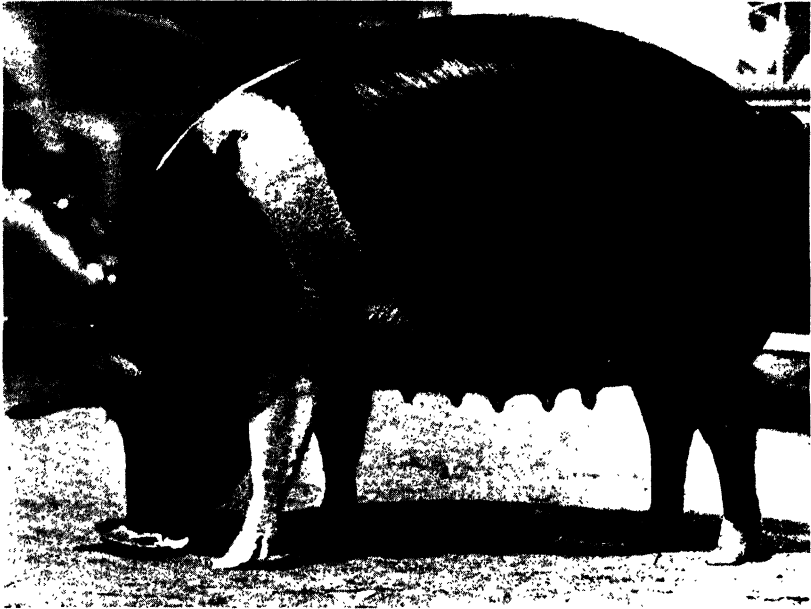


FIG. 176. An outstanding Hampshire sow, Rosedale Kit, All-American Hampshire aged sow, 1939. Bred and owned by Rosedale Farms, Ft. Dodge, Iowa.

Breeding Stock Selection

As but a small percentage of any crop of pigs is necessary to produce the next crop, swine breeders have an opportunity to practice rather heavy selection in choosing the replacements for the breeding herd. The average interval between generations in swine is two to three years; that is, the parents have an average age of about two and one-half years when their offspring are born. Of course, it is possible in swine for the sow producing the litter and the sire of the litter to be not more than 12 months

of age when their first litter is born. The average is greater because many of the sows are kept for more than one litter and also herd boars are often kept for more than one pig crop. Cases are on record where swine have produced offspring when over ten years of age. It has been estimated that 10 to 15 per cent of the sows and 1 to 2 per cent of the boars produced are needed for replacement if the hog population is not increasing. Compared to other classes of livestock, the number of swine needed for replacements is much lower because of the much higher productive rate of the brood sow than the mare, cow, or ewe.

BASIS FOR SELECTION

We can select individuals for the breeding herd on the basis of conformation or individuality, the pedigree, or the perform-

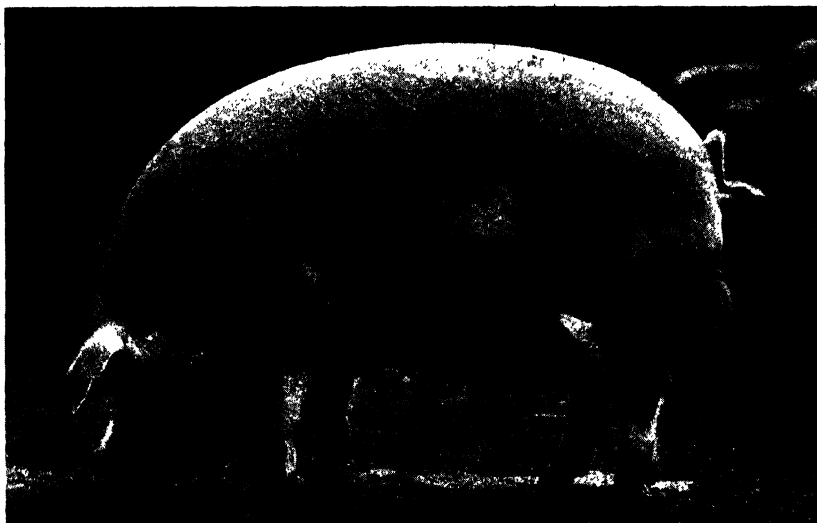


FIG. 177. A Chester White boar, King Model First, grand champion at the Iowa and Indiana State Fair, 1940. Owned by C. T. Keen and Son, Marshalltown, Iowa.

ance. Performance is the best single basis, but this is only available when an individual has produced. Consequently, our breeding herd selection often is based on appearance, pedigree, and performance of the individual's close relatives.

Hog raisers range from the purebred breeder to the market

hog raisers, and selection is a far different matter for one grower than the other. The producer of purebreds, because of the sale of breeding stock from his herd, retains for breeding a high percentage of the hogs raised. The market hog raiser, on the other hand, may sell all of his pig crop for slaughter. The farmer who raises market hogs is dependent upon the swine breeder for his replacements and selects, therefore, what he thinks will be economical converters of feeds into gains. He also has some idea what the meat packer wants, and tries to satisfy him. Briefly, the man who raises market hogs wants a kind that will make rapid gains on a low feed requirement and that will be in demand when finished for market. His selections are, therefore, based on these two main objectives. Fortunately, there is no conflict between the characteristics necessary to accomplish these objectives. It is possible to have in the same individual efficient and rapid conversion of feed into gains and high desirability of carcass.

TYPE FOR THE COMMERCIAL PRODUCER

The breeder who sells breeding stock to the market hog raiser must have what the commercial producer needs in order to continue in the swine breeding business. Such breeders must practice selection to hold high merit in the herd. They, likewise, cannot afford to sell for breeding anything that they think might prove inferior. Actually, even in supposedly well-selected individuals, the response in the breeding pen is not always satisfactory.

Perhaps some of the features of selection should be pointed out before a plan of selection is suggested. In the first place, selection is usually the most effective when first practiced, and then diminishes in effectiveness. If, for example, we are selecting heavily for litter size, the first steps in that direction are likely to be the more effective. After the size of the litter has been increased, further improvement is less rapid. In fact, heavy selection may be necessary to hold the gain. This quality of selection is a factor in buying a herd boar. A boar may show marked improvement in the offspring when used in a herd of average merit while in a herd of superior sows the progeny may be below the herd average. Seldom in selection do we gain as

much as we expect to. We get but a portion of what we select for. Selection may be a very effective means of altering a characteristic in a breed. However, in deciding what to keep in the breeding herd we are always confronted with the fact that we are selecting for many characters at once. The individual selected is a composite and represents a series of concessions in regard to many characters. Selection effects are difficult to separate from influences which may cause changes that are nongenetic. For example, at a Swedish agricultural experiment station the feed to produce 1 pound of gain on growing and fattening pigs was reduced from 4.15 to 3.35 pounds in a 15-year period. This increase in efficiency was due, no doubt, to improvement of feeding methods as well as better breeding.

DESIRABLE CHARACTERISTICS

Briefly, it might be well to review what we desire in our breeding hogs, i.e. the points we should consider in judging or selecting breeding hogs. For the brood sow, these considerations might be broken up into the following general headings.

1. **SIZE.** Rather large size is demanded in breeding hogs because it is the potential size which imparts the quality of rapid growth. Rapid growth and economical gains are positively correlated. We can have too much size in breeding hogs, as was evident in the extreme or rangy type. If the pigs have been full fed and do not have sufficient finish at the 200-pound weight the parents are probably too large.

2. **FORM.** The form desirable in a market hog is highly acceptable in a breeding sow. Less width and a little more length of body and legs are typical of the breeding gilt at 200 pounds as compared with a market barrow. Extremes in either direction are to be avoided. The tall, rangy kind lacks in fleshing qualities, while the short, compact kind finishes at too young an age and lacks growing qualities. All things considered, the intermediate type is the most desirable. A strong, evenly arched top, smooth sides and shoulders, uniform width, and heavy hams suit the most critical in form.

3. **QUALITY.** In the breeding sow, quality is usually a matter of smoothness and trimness. It should not be carried to the

point of sacrifice in size, ruggedness, or ample bone. A good growth of hair is desirable, but curly, bristly, or wavy coats are objectionable. Swirls or rosettes in the hair are on most pure-bred swine objectionable when along the top line.

4. **FEEDING QUALITIES.** The qualities associated with feeding capacity are highly desired in breeding hogs. Length, width, and depth of body are the principal indicators of capacity to convert feed into gains.

5. **MATURITY.** As early market maturity is essential in a

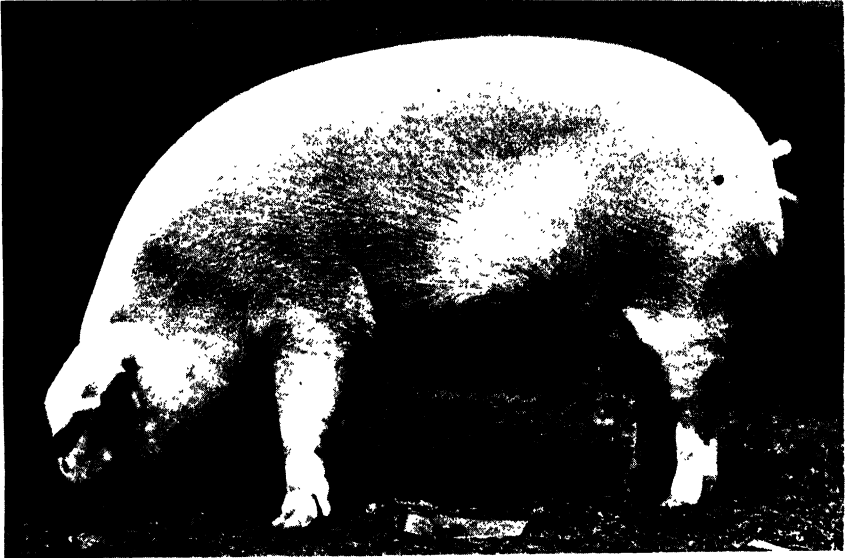


FIG. 178. A Chester White sow, Annabelle, grand champion at the Illinois, Iowa, Nebraska, and Kansas State Fairs in 1939. Shown by Warren Conner, Glidden, Iowa.

good market hog, it is also requisite in the brood sow. To be finished for market at a young age and at desired market weight is the objective in the market hog, and for the brood sow we want evidence that she will produce that kind.

6. **FLESHING.** High condition or fatness is neither advantageous nor desirable in a brood sow. Yet heavy fleshing as indicated by wide, plump hams and ample width of back and loin is highly desirable.

7. **VIGOR.** As hogs are often troubled with parasites and disease, we should select only those with strong constitutions, as

shown by a deep, wide chest, strong heart girth, and a body of good depth. An active, animated appearance indicates strong vigor.

8. FEET AND LEGS. Strong underpinning is of great importance in breeding sows. The ideal set of legs is such as is preferred in the draft horse, that is, straight and under the four corners. Hog men, however, desire straight rather than sloping pasterns. With reference to breeding hogs, hog men often use the word "soundness," which regularly refers to a freedom from any noticeable defects.



FIG. 179. Rookwood Ideal 12th. A grand champion Berkshire boar, Iowa State Fair, 1941. Owned by C. F. Curtiss, Ames, Iowa.

9. BREEDING QUALITIES OR SEX CHARACTERISTICS. A good brood sow is one that can successfully suckle a large litter. She should have at least ten teats of uniform size and evenly placed. Inverted or blind teats, which are those that fail to emerge, should be discriminated against. The udder, together with general refinement throughout, is regarded as an index of the maternal qualities of the sow.

10. DISPOSITION. A sow that is quiet and has a tractable disposition will be more likely to prove herself as a good pig raiser. In the usual herd, sows must be handled a great deal, consequently a good disposition is highly essential.

II. CONSTITUTION AND HEALTH. Great caution should be given to vigor and health as disease control is a very important consideration. The absence of unusual symptoms as a cough, a rough hair coat, a poor appetite, or a thin condition assures one that the individual is probably in good health. Yet there are numerous diseases of swine which are not readily recognized by external symptoms. It is also well to guard against such



FIG. 180. A junior champion Berkshire sow at the 1940 Illinois State Fair. Owned by Lynnwood Farm, Carmel, Ind. (American Berkshire Association.)

things as common intestinal worms, lungworms, hog mange, and other parasitic conditions.

12. BREED TYPE. The difference between breeds in physical characteristics is referred to as "breed type." These differences in swine are largely in size, color, form, shape of the head, carriage of the ears, and other features which are distinctive of the breed. These characters are not highly related to utility.

All the above points have a bearing on selecting the individual brood sow. The various points are not evaluated because a notable deficiency in any one would constitute a disqualification.

These items are considered always in respect to age and the changes incident to age.

For the breeding boar, we would use much the same pattern, altering only such things as apply to the sex. More ruggedness is wanted in the herd boar. Masculinity is also stressed.

OTHER GENERAL FEATURES TO BE CONSIDERED IN SELECTION

In addition to the features which are determined by the inspection of the individual, or individuality, there are other items to survey in making a selection. Following are listed some of the more important features.

1. **ANCESTRY, PARENTAGE, OR PEDIGREE.** By knowing something about the ancestry of an individual we can make some estimate of its breeding ability. Of course, immediate ancestors are a better basis for judging an animal's worth than remote individuals in its pedigree. An individual receives a sample inheritance from each of its parents. The sample received is a matter of chance, and as individuals are not homozygous or pure for all their characters, it is impossible to estimate from pedigree alone what an offspring will be. On the other hand, consideration of the pedigree may help to eliminate some of the errors that might be made if selection were on individuality alone.

2. **PERFORMANCE.** Future performance can not be forecasted without error. There are many different measures of performance or progeny tests, which may be helpful in making an estimate. We have in swine husbandry applied some measures of production. Yet this has been more difficult for swine than for some other classes of livestock. In dairy cattle, for example, the production of cows has been measured by the milk scale and the Babcock test; standards have been set up, and selective registration based on performance is practiced. What have hog men to use in measuring production? Following, a few are listed: (1) records on litter size, (2) measuring of weight for age for pigs and litters at various ages, (3) feeding trials, (4) production contests, (5) interbreed competition in on-foot and carcass classes, (6) record of performance test. By means of these tests we hope to acquire in our brood sows high prolificacy, heavy litters of

pigs, pigs with high efficiency in making gains, and pigs of high carcass value.

Selection has a definite field of usefulness in the swine herd and breed improvement. It does also have limitations. In the first place, it is difficult to segregate the effects of environment from the effects of heredity. Then, too, the ideal hog is a composite of many features and, therefore, progress toward improvement in any one character by selection may be slow. Our ideal for many characters is not toward either extreme but the intermediate (like type), consequently we cannot put selection pressure on any one character to the exclusion of others.

Chapter 29

SHEEP — GENERAL VIEW

Sheep, like other of our domesticated farm animals, were used by man or domesticated prior to our historic time. In the days of pastoral agriculture, sheep raising flourished, as they were raised entirely upon herbage. Sheep were easily domesticated, and one person could care for a large flock. They were a source of meat, wool, pelts, and milk, and early in man's culture they became the object of husbandry. Shepherding is one of man's oldest professions.

Time of Domestication

Domestication of sheep, in all probability, was coincident with the early Neolithic age. Sheep are referred to in the first writings of man and they were among the first animals to be domesticated. In the earlier passages of the Bible, sheep are mentioned. The word "sheep" is of ancient origin. The word "avi," in Sanskrit, was applied to sheep, and its meaning is to keep or to guard. Early man tamed, confined, and protected or guarded sheep which yielded meat, milk, and skin for his use. Sheep are pictured on the earliest Egyptian monuments, which date some time between 5000 and 4000 B.C. Sheep were also used by the early people of Europe, as bones have been found in the inhabited caves and the lake dwellings.

It is quite probable that sheep were domesticated in different regions or at different times, rather than descending from a single wild species. Central and western Asia, probably Turkestan, were the first places of domestication.

With the spread of civilization, sheep moved to the countries where they could be grown. Today sheep husbandry is practiced in practically all agricultural regions.

Zoological Classifications

Domesticated sheep as well as goats belong to the sub-family *Ovinae* (*Caprinae*). This in turn is a part of the *Bovidae*

family which includes cattle, antelopes, chamois, musk ox, and others, all of which are hollow-horned ruminants. The sub-family *Ovinae* are principally highland or mountain dwellers, and there are many divisions of the group. The genus *Ovis* includes all sheep, and the domesticated sheep are of the *aries* species.

Differences of opinion exist as to which of the several wild species is the progenitor of domestic sheep, and it seems quite probable that they may stem from several sources. The wool-specialized breeds are supposed to have spread from Asia Minor through Greece and Italy to Spain. The wild sheep of northern Europe domesticated by the Nordic tribes are the assumed foundation for the mutton type.

Classes of Sheep

Within the range of the animals classed as sheep there is a wide variety of races and breeds. The tail characteristic is extremely variable in sheep, as is the nature of the hair or wool. The following classes of sheep are recognizable.

1. *Longtail Sheep*. This includes the sheep common to the United States, which for the most part came from Europe. Likewise the hairy sheep of Africa, such as the Persian, are in this group.

2. *Fat-Tailed Sheep*. The Karakuls are typical of this group. They have a long tail which is broad, flat, and tapering rapidly toward the end.

3. *Short-Tailed Sheep*. Marsh or moorland sheep of northern Europe are of this kind.

4. *Fat-Rumped Sheep*.¹ There are several local breeds of this kind throughout central Asia. The distinctive feature is the fat on the rump which is in the form of two great cushions, divided by a median cleft on the buttocks.

¹ An attempt is being made to develop a breed of sheep without tails at the South Dakota Agricultural Experiment Station. Fat-rumped sheep from Siberia were used with domestic breeds, the object being to develop a breed that had desirable mutton and wool qualities and would not have to be docked. James W. Wilson, "Development of the No-Tail Sheep," *Circ.* 28, South Dakota Agr. Exp. Sta., 1940.

Introduction to the United States

The Big Horn or Rocky Mountain sheep, which are confined to the Rocky Mountain region from Alaska to California, were native to this continent. However, domesticated sheep were first brought by the Spanish explorers. Columbus brought sheep and goats in 1493. Cortéz brought Merino sheep into Mexico in 1530. The Spaniards who founded Sante Fe in New Mexico were thought to have brought in multicolored sheep from which the Navajo Indian sheep descended. English breeds of sheep were brought over to the colonists along the eastern seaboard, and they were moved westward with colonization. Merino breeds from Spain were first introduced in 1783 to the United States and by 1810 there developed a strong demand for such sheep. Heavy importations of Merinos were then made for a few years from Spain, but that import demand came to an end in 1816.

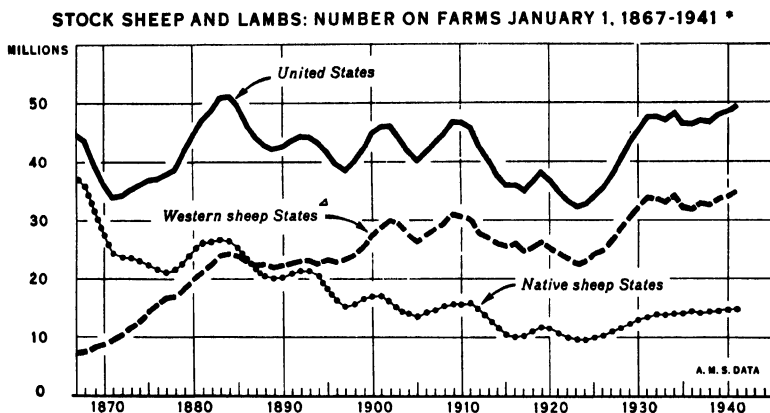
Growth of Sheep Production in the United States

The sheep population of the United States was estimated at 7 million head in 1810. As sheep production moved westward with pioneering farming, the numbers increased. By 1830 farming had crossed the Allegheny Mountains, and in 1840 there were 19 million head reported in the census. The Civil War affected sheep production, first by causing an increase in the price of wool because of the demand for woollen goods, and second by limiting the supply of cotton. Following the war, wool prices fell because of lessened demand and increased competition from cotton and imported wool. Following the expansion and contraction due to the Civil War, numbers of sheep increased, and in 1883 and 1884 our estimated number on farms exceeded 50 million head of stock sheep, which has not been equaled since. In the early 1940's sheep population increased and it may exceed the 1884 high before long.

Sheep were raised in our pioneer agriculture mainly for wool. In the farming states the mutton type sheep are more suitable for most of the systems of farming; consequently, the fine wool sheep are localized in certain of the farming areas and are extensive in the range country.

Stock Sheep and Lambs in the United States

Stock sheep and lambs are those sheep which are maintained upon the ranches and farms and which are not in the productive process of being fed out for market. This latter group are designated as sheep and lambs on feed. Yearly estimates are made of the sheep and lamb population as of January 1, and this estimate is then broken up into stock sheep and lambs, and sheep and lambs on feed. For the decade 1930-1939 the



* Excludes sheep and lambs on feed for market.

△ Includes 11 western states, Texas and South Dakota.

Data for 1941 are preliminary.

FIG. 181. Sheep numbers are not static. Since 1867 the trend has been neither upward nor downward. Increases in the western sheep states have been offset by decreases in the native sheep states. Western states have not shown much change in numbers since 1930, while during that period sheep have increased slightly in the other states. (U.S.D.A., Bur. of Agri. Economics.)

number of stock sheep and lambs was about 47 million head, and there were about 5.7 million sheep and lambs on feed. Although stock sheep and lambs have not shown any decided trend in numbers, there has been an upward trend in the number on feed for market. (See Figure 181.)

Considering the greater number of lambs on feed in recent years the estimates of total sheep (both stock and feeding) have reached an all-time high. The peak of population of 53 million head of sheep on January 1, 1884 was surpassed four out of the ten years in the 1930-1939 decade.

Areas of Sheep Raising

The distribution of sheep in this country is shown in Figure 182, and the changes in sheep production as indicated by the number of stock sheep are shown in Figure 181. About 70 per cent of our breeding or stock sheep are in the 17 western states, where there is also considerable winter lamb feeding. The breeding flocks in this area are grazed on the native vegetation of the range and use much of the forage grown in this great pasture area. Sheep can be ranged on the more arid lands more easily than other domestic animals. The sheep industry first developed in California and New Mexico and later spread to the other range states. Montana and Wyoming were the last of the range states to be reached by sheep production. Sheep are widely spread through the western states, but heavy concentrations are in the Edwards Plateau of Texas, the Great Valley of California, and the irrigated valleys in the range area.

Sheep raising has not always centered on the western range. About a century ago Vermont was a leading sheep state. Sheep have persisted in the hilly section of the east and midwest. It will be noted that heavy concentrations of sheep numbers exist in east central Ohio, southwestern Pennsylvania, West Virginia, Virginia, southern Michigan, north central Kentucky, Indiana, central Tennessee, northern Missouri, and southern Iowa.

The center of sheep population for this country has moved westward with each census and now is in the region of southwestern Nebraska. There has been some slight veering from a straight westward movement. Productive conditions cause the sheep population to shift, but in general the feed supply is the greatest factor in such changes.

Farms and Ranches Raising Sheep

The recent agricultural censuses show that sheep are reported on 9.3 per cent of the farms and ranches. The states in the east north central geographical division (Ohio, Indiana, Illinois, Michigan, and Wisconsin) have the largest proportion of farms and ranches with sheep. Other divisions that have a large proportion of farms and ranches with sheep are the mountain and west north central. The west and east south central and the south Atlantic sections have but few farms with sheep.

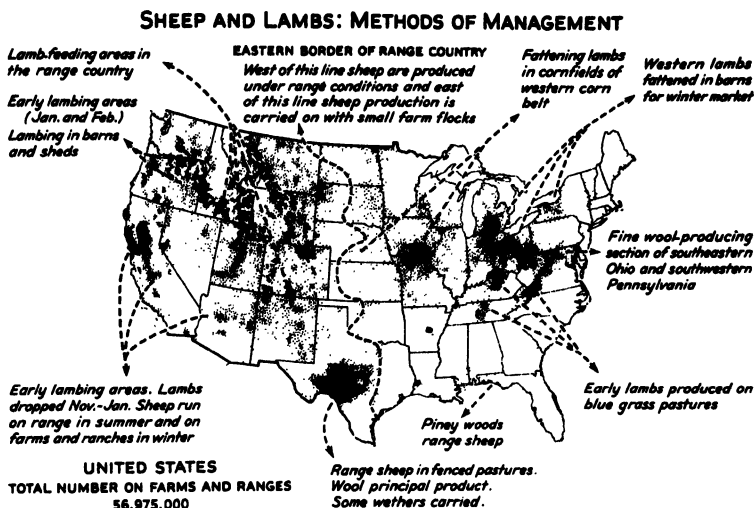


FIG. 182. Distribution of sheep and lambs in the United States. (U.S.D.A., Bur. of Agri. Economics.)

About one-fourth of the farms and ranches of Wyoming, Ohio, and Nevada have sheep, while in South Carolina, Florida, and Alabama about one in 200 farms reported sheep.

Leading States in Sheep Production

Sheep production of the various states may be compared by the sheep numbers of the states. Following is a listing of some

SHEEP — NUMBERS IN LEADING STATES, 1935-1939 AVERAGES¹

<i>State</i>	<i>Thousand Head</i>
Texas	8,364
Wyoming	3,444
California	3,442
Montana	3,137
Utah	2,412
Ohio	2,216
Oregon	2,211
Idaho	2,047
New Mexico	1,938
Colorado	1,670
Missouri	1,287
Iowa	1,224
South Dakota	1,207
Kentucky	1,096
Michigan	1,038
United States	52,640

¹ U.S.D.A., *Agricultural Statistics 1939*, p. 337.

of the states leading in sheep numbers. These numbers are the average of yearly estimates which are made as of January 1 of each year and include stock sheep and those on feed. In other words, it is a complete sheep inventory.

Sheep Population in Leading Sheep Countries

The United States is excelled only by Australia in sheep numbers. Australia, South Africa, Argentina, and New Zealand are large sheep producing countries. The ratio of sheep to human population is wide in those countries; therefore, a considerable portion of their production, especially wool, enters the world trade. In this country we have less than one sheep for two inhabitants, and we produce about all the mutton and lamb we use and import only about one-third of the wool we use. Since our population has been increasing and sheep numbers have not shown any decided trend, the ratio of sheep to people has widened. In the decade ending in 1870 the ratio was even. In Australia there are over 16 sheep to each human inhabitant.

The sheep population of the entire world is about 698 million

SHEEP — NUMBERS IN LEADING SHEEP COUNTRIES, 1931-1935 AVERAGES¹

<i>Country</i>	<i>Thousand Head</i>
Australia	111,417
United States	53,248
Union of Soviet Socialist Republics	52,960
Union of South Africa	44,054
Argentina	40,566
New Zealand	28,793
India:	
British	24,968
Native States	18,444
China	24,000
Uruguay	17,982
Spain	17,948
England and Wales	17,468
Rumania	12,177
Peru	12,000
Brazil	11,876
Turkey	11,555
Italy	9,566
France	9,812
Estimated world total	697,900

¹ U.S.D.A., *Agricultural Statistics 1939*, pp. 340-341. Average of five-year period if available, otherwise for any year or years within the period.

head. Therefore, we have about one-fourteenth of the sheep production of the entire world.

On page 474 is a list of the leading sheep raising countries and their sheep population for a recent five-year period.

Origin of Breeds

Most of our domestic breeds of sheep originated in Great Britain. There are more than 200 breeds of sheep. In our

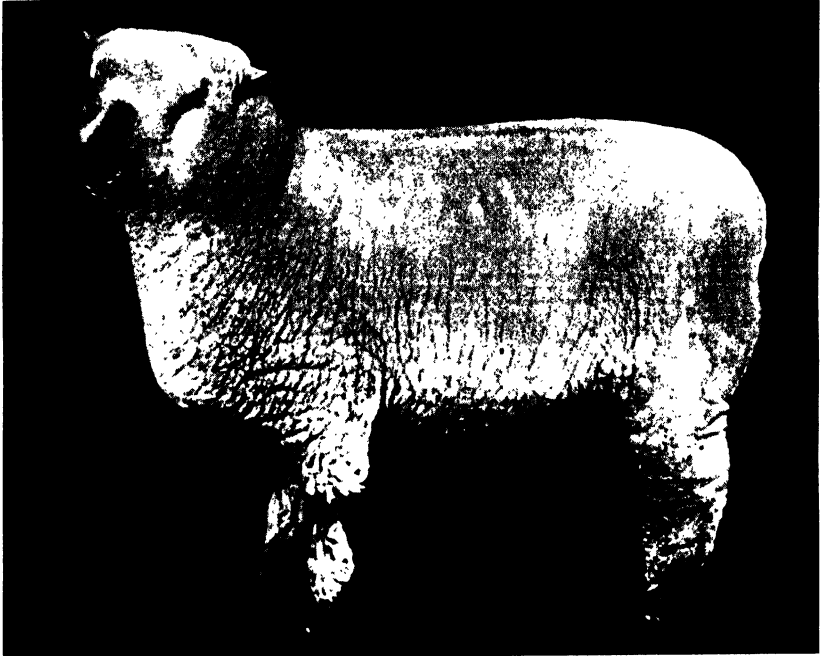


FIG. 183. A medium wool sheep. Shropshire wether lamb, grand champion wether at the 1940 American Royal and the International Livestock Exposition. Bred and exhibited by the Iroquois Farm, Iroquois, New York.

census enumeration of registered purebred sheep 18 different breeds are listed separately, while a large number are included in the group of other and unspecified breeds. Breeds of sheep were developed to meet specialized conditions, and it is quite common to name the breeds for the county in which they originate.

In general, the breeds of sheep vary in their type, character, and fineness of wool, size, and presence or absence of horns.

Color markings, or color of the hair on the face, ears and legs, wool covering, form, shape of the head and ears are also features in which breeds differ.

Classification of Breeds According to Type

On the basis of principal use, sheep breeds are divided into two types — mutton and wool. Mutton sheep are often divided further on the basis of the character of the wool into medium wool and long wool breeds.

<i>Type</i>	<i>Subtype</i>	<i>Breed</i>
Mutton	Medium wool	Shropshire
		Hampshire
		Dorset Horn
		Southdown
		Cheviot
		Oxford Down
		Suffolk
		Tunis
		Corriedale
		Ryeland
		Columbia
		Panama
		Romeldale
		Targhee
Mutton	Long wool	Lincoln
		Cotswold
		Leicester
		English Border Leicester
		Romney Marsh
Wool	Fine wool	Blackfaced Highland
		Merino (American and Delaine)
		Class A
		Class B
		Class C
		Rambouillet
Fur		Class B
		Class C
		Tasmanian Merino
		Karakul

In some classifications a carpet wool type is recognized, which includes the Blackfaced Highland breed. The breeds which have resulted from a long wool, fine wool cross, such as the Corriedale, Columbia, Panama, and Romeldale, are sometimes termed the "crossbred wool type."

Medium wool sheep are kept primarily for mutton and lamb production. The wool on this class is medium in length, fineness, and weight. A 12-month growth will range from 2 to 5 inches in length. The fleece is usually quite compact and light colored on the exterior. This class is likewise medium to large in size.

Long wool sheep are also primarily mutton sheep. The fleece is light colored, high in luster, and hangs in definite curls or

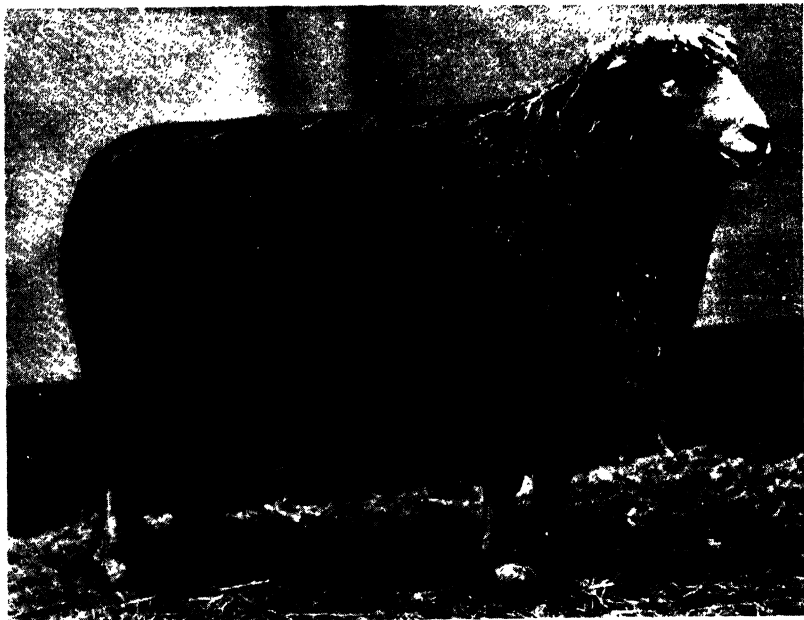


FIG. 184. A long wool sheep. A Cotswold ram, grand champion at the International Livestock Exposition, 1939. Owned by Harry T. Crandell, Jr., Caro, Mich.

locks. The wool is distinctive and it is long, lashy, and hair-like in appearance. A length of from 5 to 12 inches is acquired in a year's growth. Long wool sheep are of large size and very rugged.

Fine wool sheep are mainly of the conformation of typical wool type sheep, and the main goal in their development has been wool production. A fleece from 1 to 4 inches in length results from a year's growth, and the fiber is very fine with numerous crimps (16 to 22 per inch). The fleece is high in yolk, very compact, and usually dark on the outside because of the



FIG. 185. A fine wool sheep. Rambouillet ewe lamb, first prize winner at the International Livestock Exposition. Bred and exhibited by King Bros., Laramie, Wyo.

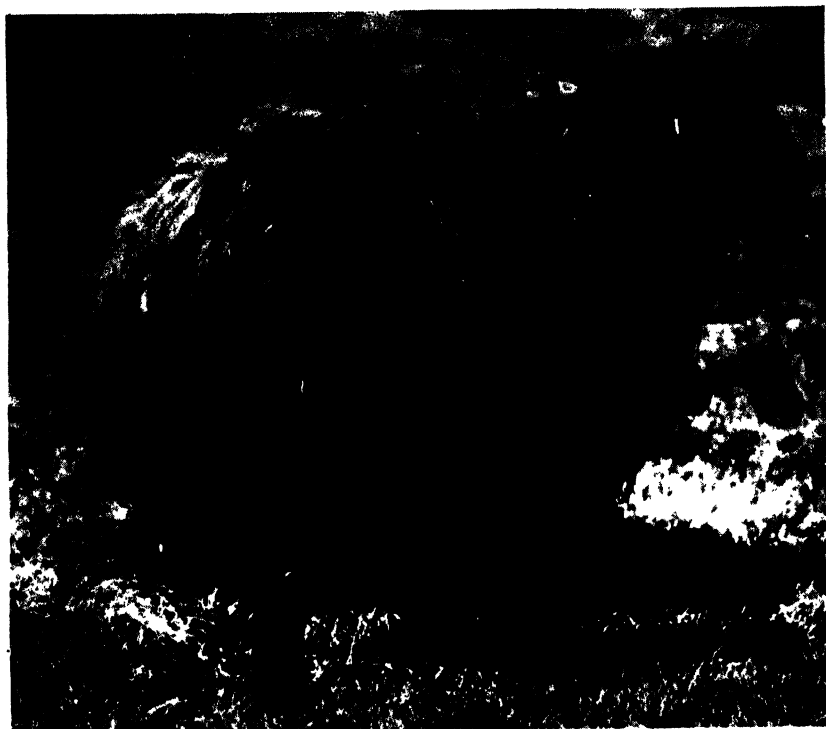


FIG. 186. The fur type. A Karakul ewe and lamb. Pelts from the lambs are used for Persian lamb fur.

dirt which adheres to it. The fine wool sheep are small or medium in size, and a white color is typical of the face and legs. Rambouillets are quite large in size, and with this breed about equal emphasis goes to wool and mutton.

Fur Type. The Karakul sheep originated in Bokhara in west central Asia.¹ Importations were made to this country as early as 1909. Quarantine laws have prevented importations since 1914. This breed is valuable because it produces lamb skins, suitable for fur. These fur skins are classed in the trade into the broadtail, Persian, and Karakul group.

Numbers of Different Breeds

The number of sheep that are registered purebred is quite low. Slightly over 1 per cent of all sheep enumerated in the 1920 census were registered purebreds, and in 1930 the percentage had declined to 0.8. About 1 farm in 19 which raised sheep reported registered purebreds.

In the 1930 enumeration the leading breeds in registered purebreds were ranked as follows: Rambouillet, Hampshire, Shropshire, Merino, Oxford Down, and Southdown.

Sheep and Cattle Compared

Sheep and cattle are both ruminants, consequently they have many characteristics in common. There are, however, some distinctive features of sheep which cause them to be more adaptable to some situations than cattle. Sheep are less adapted for the consumption of coarse roughage than cattle. Yet they can utilize short herbage effectively because of their cleft under lip which permits close grazing. Poor quality, scanty, arid, rough pasture, cut over and wooded areas, and crop aftermaths are usable with a flock of sheep. Short grasses and herbage and small bushes are grazed more extensively by sheep than other domestic grazing animals except goats. Sheep can be handled in comparatively large flocks. It is not unusual for one herder to take care of a flock of over 2000 head on the range. Farm flocks are usually kept under 40 head of breeding ewes.

¹ C. G. Potts, "Karakul Sheep," *Farmers' Bull.* 1632, U.S.D.A., 1931. Karl Jahn, *Karakul Fur Sheep Breeding*. Breeder's Publications, Chicago, 1937.

Show Ring Classification of Sheep

At the livestock shows and expositions sheep are in two main divisions, breeding and market or fat sheep. There may also be classes for feeder sheep. The breeding classes are for purebreds, while in the market or fat and feeder classes purebreds, grades, and crossbreds compete. The show classification for sheep is somewhat more uniform than that for cattle. The usual base date for computing age is September 1. In market or fat classes the showing is generally limited to wether lambs, and there are group classes which include pens of three and carloads. In the showing of breeding sheep three classes are common for rams. These are two years or over, one year and under two years, and lambs under one year. Often the older class is deleted from the classification for breeding ewes, and only yearling ewes and ewe lamb classes are shown. There are classes for groups such as flock, get of sire, three ram lambs, and championship awards for individuals.

Chapter 30

MUTTON TYPE SHEEP

Sheep are classified, on the basis of the main objective in their production, into mutton type and wool type. Mutton sheep have been raised mainly for the economy and the quality of their meat. Breeding and feeding in this type were pointed mainly toward meat production, and the fleece was a secondary consideration. More emphasis has been placed on fleece in some breeds of the mutton type than in others. It will be recalled that the breeds classified as mutton type were divided into two classes — the medium wool and the long wool. Although there are many breeds of the mutton type, there is a considerable range in size and ruggedness, body and head shape, color, markings, wool covering, and character of the fleece. The wool is not to be minimized; even in mutton sheep flocks, ewes efficient in both lamb and wool production are needed for profit.

Sheep have a fleece which is variable in length and which can be modified by trimming. Consequently, the handling of sheep is imperative in judging. Even on the market, sheep are handled to determine the fleshing. In sheep judging a systematic, thorough examination is essential for an understanding of the various features of form which affect a sheep's value for a given purpose.

Detailed Description of the Ideal Mutton Type

THE MUTTON SHEEP SCORE CARD

The score card is a description of the standard of perfection or ideal. It is of value in making a detailed study of an individual as the various parts are enumerated. Also, the relative value or

importance of the different parts is given. The common score card is for fat or mutton market sheep or those that are finished for marketing. Standards of perfection for breeding ewes or bucks and also feeder sheep are somewhat similar to those for market sheep, as breeding flocks of good mutton type should produce the desired kind for market, and good feeders finish into the kind in demand on the livestock markets. The mutton

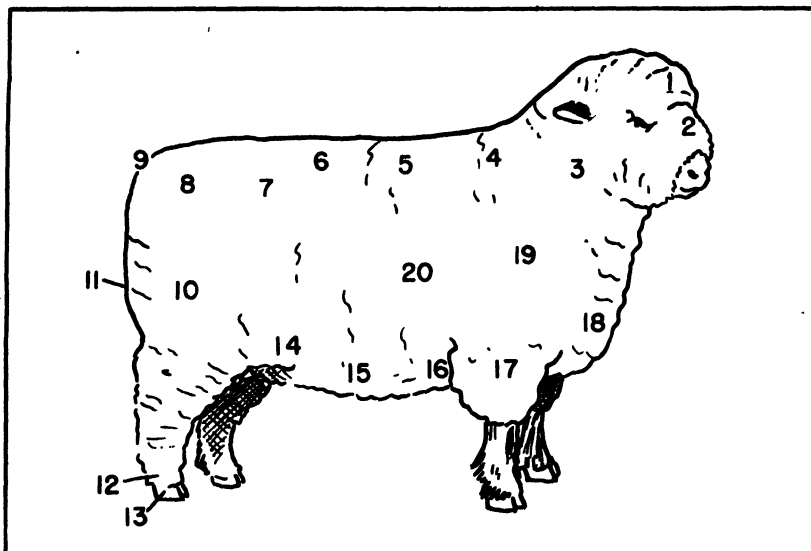


FIG. 187. Parts of the sheep.

- | | | |
|--------------------|----------------|----------------|
| 1. Forehead | 8. Rump | 15. Belly |
| 2. Face | 9. Dock | 16. Fore flank |
| 3. Neck | 10. Thigh | 17. Fore leg |
| 4. Top of shoulder | 11. Twist | 18. Breast |
| 5. Back | 12. Pastern | 19. Shoulder |
| 6. Loin | 13. Foot | 20. Ribs |
| 7. Hip | 14. Rear flank | |

sheep standard is patterned after, and in many features it is similar to, the one used for the beef steer. The common anatomical parts of the sheep are shown in Figure 187.

SUGGESTED STUDENT SCORE CARD FOR A MARKET SHEEP

Following is a market sheep score card suitable for instructional use.

FAT SHEEP

*Scale of Points***GENERAL APPEARANCE — 41 points**

1. **WEIGHT** — according to age and market requirement
2. **FORM** — wide, deep, compact, low set, straight top line and under line, trim middle, stylish, symmetrical
3. **QUALITY** — free from coarseness; smooth in form and fleshing
4. **CONDITION** — degree of fatness indicated by thick, firm covering over shoulder, back, loin, and ribs, thick dock, and plump breast; no soft, loose fat
5. **DRESSING PERCENTAGE** — high condition, trim middle, light pelt

HEAD AND NECK — 4 points:

6. **MUZZLE** — wide, strong
7. **EYES** — large, open, quiet
8. **FACE** — short, forehead wide
9. **EARS** — fine, well carried
10. **NECK** — short, thick, throat clean

FORE QUARTERS — 7 points:

11. **SHOULDERS** — smoothly joined with neck, wide and smooth on top, well covered
12. **BRISKET** — wide, full, trim
13. **LEGS** — straight, short, strong, wide apart, forearm thick

BODY — 26 points:

14. **CHEST** — wide, deep, full back of shoulders
15. **BACK** — wide, straight, thickly and firmly fleshed
16. **RIBS** — well sprung, deep, thickly and firmly fleshed
17. **LOIN** — wide, thick, firm, smoothly covered

HIND QUARTERS — 13 points:

18. **RUMP** — long, level, wide to the dock, covered with thick, firm flesh
19. **LEG OF MUTTON** — deep, wide, plump, heavy
20. **TWIST** — deep, full, firm
21. **LEGS** — straight, short, wide apart

FLEECE — 9 points:

22. **QUANTITY** — dense, long, body completely covered
23. **QUALITY** — fiber fine, crimp close and even, uniform, free from dark fibers
24. **CONDITION** — sound, bright, clean, soft, lustrous; sufficient yolk, evenly distributed

SCORE CARD POINTS

There follows a discussion of the different parts of the fat mutton sheep.

1. **GENERAL APPEARANCE.** Most of the features are appraised at some distance away from the sheep.

a. Weight. Weight for age is an important item because fast gains are usually economical gains. In sheep we have a market which prefers lambs, and generally lambs that are 90 pounds or

under. Heavier lambs may at times top the market, but the general preference is for the lighter weights. Size is dependent upon the breed. In the Southdown breed, which is the smallest of the mutton breeds, the ewes at maturity weigh from 135 to 155 pounds. The ewes of the Lincoln breed, which has the greatest size, weigh 250 pounds. Lambs from very large parents



FIG. 188. A Southdown wether lamb, reserve grand champion wether, 1940 International Livestock Exposition. Shown by Pennsylvania State College.

may not have sufficient fatness to top the market at the desirable weight.

b. Conformation. The form desired in market sheep is similar to that of the beef steer. A typical mutton form is one in which there is ample width, depth, compactness, and low-setness. Straight lines, both top and sides, are desirable, as is also a trim middle. Symmetry and style are features of form which affect market value. A blocky, muttoney form is desired.

c. Quality. As this term relates to the form and fleshing, it is far less important in the sheep than in the beef steer. Some

range of quality is observed, and high quality is indicated by freedom from coarseness, combined with smoothness and neatness of form and fleshing and fineness of bone. The head, which is refined, clean cut, and covered with fine hair or wool, shows quality. Quality is also denoted by the fineness of the fleece.

d. Condition, Finish or Fleshing. Of the individual items on the score card condition carries the greatest weight. Lambs of acceptable weight are seldom overfat. Usually underfinish prevails in market lambs. The covering over the shoulder, back, loin, and ribs, the thickness of the dock, and the plumpness of the breast indicate the fatness or condition. A thick, firm, uniform covering is desired. The fatness is estimated by the spinal covering; a fat lamb has a large amount of covering on his backbone, while a thin one has a prominent backbone with little covering. Fat lambs or wethers are pretty largely placed by the covering which they have on the shoulder, back, ribs, loin, and rump, and the fleshing of the leg of mutton.

Sheep, especially those older than lambs, can be too fat and wasty. Heavy accumulations of fat in the foreflank are not uncommon in older sheep. This is commonly referred to as "slipped," but actually there is no slipping of fat from the upper part.

e. Dressing Percentage. Finished sheep that are trim in the middle and light in the pelt dress high. A lower dressing percentage, because of a heavy fleece, is not objectionable, as the fleece sells for more than the carcass.

2. HEAD AND NECK. Although this is listed as a major division, the weight value on the score card is low. A broad, short head, with a wide, strong muzzle, large, open, quite clear eyes, a short face, wide forehead, and fine well-carried ears is desired. The neck should be short, thick, and trim at the throat. In breeding sheep more emphasis is given to the head and neck, as each breed is somewhat distinctive about the head. The shape, carriage, color, and ears are features that are characteristic and quite uniform within a breed. There is much difference in the breeds in the size, shape, and wool covering of the head.

3. FORE QUARTER.

a. Shoulders. If the shoulders are smoothly joined with the

neck, well covered with flesh, wide and smooth on top, they are considered ideal.

b. Breast. The breast should be wide, full, and trim. A good, well-finished market sheep has a plump breast, and this is of great importance in a breeding sheep as it is an indication of constitution.

c. Legs. Straight, short, strong front legs, well set from both the front and the sides, are desired. Usefulness on the range and in the feed lot is dependent upon ample underpinning. A thick, well-developed forearm is in keeping with ideal mutton conformation.

4. **BODY.** This section includes several parts which yield valuable mutton and lamb cuts. Therefore, this division is second only to general appearance in weight of score.

a. Chest. Width and depth of chest are stressed, as is also fullness back of the shoulders. A strong constitutional vigor is indicated by a chest or breast of ample development.

b. Back, Loin, and Ribs. As a straight top line is wanted, the back and loin should be straight, and these parts are wide, thick, smooth, and firmly fleshed in the ideal mutton sheep. The ribs should also carry the heavy, smooth flesh, and be well sprung to give a wide back. As these parts yield the high-priced cuts, mutton sheep are carefully handled over the back and loin to ascertain the flesh covering.

5. **HIND QUARTERS.** The hind quarters are given considerable weight because the leg of mutton is a high-priced cut of meat.

a. Rump. In the carcass the rump becomes a part of the leg of mutton. On foot the desired conformation is one in which the rump is long, level, wide to the dock, and heavily fleshed.

*b. Leg of Mutton.*¹ Next to the back and loin this part carries the most score card weight. Light legs of mutton are too common. A heavy, plump, deep, wide leg of mutton is wanted in a good slaughter sheep.

c. Twist. As this is the inner thigh and forms a part of the commercial cut leg it should be deep, full, and firm.

d. Legs. Well-set hind legs with straight hocks are desired.

6. **FLEECE.** In mutton sheep fleece is of secondary impor-

¹ On a lamb this part is referred to as the "leg of lamb."

tance. Yet on the score card for a mutton sheep it is given about 10 per cent of the total value. Although breeders of mutton sheep have recognized that wool sells for more than mutton, they have also found that too much emphasis on wool will result in inferior mutton conformation. In judging mutton sheep it is common to consider the quantity, quality, and condition of the fleece. For a more complete discussion of the factors affecting market value of wool the student is referred to the chapters on Wool and Wool Sheep.

a. Quantity. A long dense fleece which covers the body fairly completely is desired. There is a marked difference in the breeds in the covering and also the amount of wool.

b. Quality. This refers to the fineness of the wool fiber. A fine fiber usually has a close, even crimp. The finer wools are usually the highest priced. Quality varies within a fleece, but a fleece quite uniform in quality is desired. Wool usually is clear white, and deviation from this, such as black fibers, is objectionable.

c. Condition. Many circumstances influence the condition of the fleece. A sound, bright, clean, soft, lustrous wool is wanted. Also a sufficient amount of evenly distributed yolk (oil or grease) is wanted as it protects and preserves the wool fibers and also helps to prevent cotting or matting of the fleece.

Additional Characters Stressed in Breeding Sheep

In breeding sheep, less emphasis is given to the fatness or condition. However, heavy natural fleshing is stressed, and the rams and ewes of the mutton type should be thick, wide, and well fleshed, even though actual fatness or condition is not high. The feet and legs are also given more attention in breeding sheep than market sheep. The selection of sheep for the breeding flock is discussed in Chapter 36.

Catching and Holding Sheep

As handling is essential to estimate their various properties, the sheep are held for examination. Sheep in a small pen can be caught around the neck or by grasping the right hind leg high up near the flank. Larger sheep are generally caught by the head and neck while smaller sheep are caught by the flank.

The left hand is then used to hold the sheep by grasping the skin and wool under the lower jaw. The right hand then is placed on the rump and dock to move the sheep about and when the sheep is held in position the right hand is placed on



FIG. 189. Grand champion wether at the 1941 International Livestock Exposition. Penn's Best Yet, a Shropshire wether, bred and exhibited by Pennsylvania State College.

the top of the head or the back of the neck. Care should be taken not to catch or hold a sheep by its wool.

Sheep Judging

OBSERVATION

Before handling, the sheep should be viewed from the side and both ends from some distance away. This observation

will give some appreciation of size, straightness of lines, compactness, length of legs, symmetry, width, depth, and also the general appearance of the head. Likewise, the set and strength of the feet and legs is to be observed. An experienced sheep man makes a careful observation of the sheep from a little distance before the closer examination and handling. A common error of the beginner is to omit or incompletely observe and study the sheep before handling. Observations may be of greater aid in placing breeding sheep than handling.

HANDLING

A systematic method of handling is desirable. It is quite common to begin the close inspection at the rear end and work toward the front, but some begin at the front end and work toward the rear. The starting place is of no importance, but complete examination is essential. The hand should confirm or reject the impressions acquired from the inspection or observation and also uncover defects not observed by vision. For best inspection and least damage to the fleece the fingers are kept together and laid nearly flat on the sheep. The ability to estimate fleshing and condition is acquired by experience.

STEPS IN HANDLING

A rather common method of procedure in the handling of sheep is as follows: A right-handed person will usually stand at the left rear of the sheep and use his right hand for the detailed examination. The top line is handled beginning at the dock and going forward to the top of the shoulder. By a slight movement of the fingers over the backbone the fleshing is noted. The neck and shoulder are handled with both hands. This inspection includes length of the neck and the smoothness with which it is joined to the shoulder, also the smoothness with which the shoulder blades are laid, and the flesh covering. The depth is noted by placing the right hand on the sheep's top back of the shoulder and the other hand on the floor of the chest just back of the forelegs.

By handling with both hands just back of the shoulders the heart girth is inspected. The hands are moved backward to

note the width of the body and the flesh covering. The width and thickness of the loin are appraised by holding the hands vertically, with one on either side of the loin. The rump is examined for its width and squareness with one hand on either side. The leg of mutton is grasped with both hands to estimate the size, thickness, plumpness, and depth. The twist is ex-



FIG. 190. Champion pen of three Southdown wethers, 1940 International Livestock Exposition. Note the difference in thickness. Because of the differences in wool length, handling is necessary to determine actual body width. Pennsylvania State College.

amined for fullness and depth by placing one hand on the top of the rump and the other palm up between the rear legs.

EXAMINATION OF THE HEAD

The teeth are usually examined, as they are a fairly good indication of age. The bite should also be examined while the lips are parted with the fingers as the incisor teeth of the lower jaw and dental pad in the normal mouth should close on one another. In polled breeds the presence or absence of horns should be noted.

EXAMINATION OF THE FLEECE AND SKIN

The wool is usually parted at the natural divisions in three places along the side of the sheep (shoulder, mid-side, and thighs) for examination. The length, density, quality, condition, and other attributes of the fleece which affect its value are determined by inspection.

FURTHER EXAMINATION

In breeding classes rams are examined to ascertain whether or not the testicles have descended into the scrotum and if they have developed normally. Ewes are examined for normal development of the udder.

Estimating Age from the Teeth of Sheep

Estimates of age can be made from the teeth of sheep. Examination of the teeth or "mouthing" is common to determine



FIG. 191. A lamb's mouth, four pairs of temporary incisors or milk teeth.



FIG. 192. A yearling mouth, one pair of permanent and three pairs of temporary incisors.

the approximate age. As a breeding ewe has a relatively short productive life, age is an important consideration in the value of a sheep.

A mature sheep has 32 functional teeth, of which 24 are molars and 8 are incisors. The incisors are on the lower jaw, and on

the upper jaw there is a dental pad. Temporary deciduous or milk teeth are typical of the *lamb*. These are replaced at quite regular intervals by the permanent incisors. The latter are larger in that they are broader and longer than the milk teeth. A *yearling* has the middle pair of temporary incisors replaced by a pair of permanent incisors. A *two year old* has two pairs, a *three year old* three pairs, and a *four year old* four pairs, or all permanent incisors. After four years of age the incisors spread apart, become worn down, and break out. The regular denti-



FIG. 193. A two-year-old mouth, two pairs of permanent incisors.



FIG. 194. A three-year-old mouth, three pairs of permanent incisors.

tion table may be altered by conditions of nutrition. Lambs usually make the first tooth change at 14 months, but it may be hastened or delayed by factors affecting the development of the sheep.

The variation of the above general rule has been studied at the Montana Agricultural Experiment Station.¹ Rambouillet ewes of good quality and of known age were examined in November. They were lambled in April and May, during the summer they were run on mountain pasture, and in the winter they were on foothill range.

¹ "Judging the Age of Sheep by their Teeth," *Circ. 149*, Montana Agr. Exp. Sta., June 1936.

Following is a tabulation of the age estimates made.

<i>Actual Age</i>	<i>Number</i>	<i>Per Cent Normal</i>	<i>Front Teeth Age Compared to Actual Age</i>			
			<i>½ Year Under</i>	<i>1 Year Under</i>	<i>½ Year Over</i>	<i>1 Year Over</i>
Yearlings at 18 months	850	84	10%	6%		
2 year olds at 30 months	490	37			6%	57%
3 year olds at 42 months	640	28			22%	50%
4 year olds at 54 months	370	88	7%	5%		

In the examination, if a permanent pair of teeth had erupted but were not up in wear it was called a half year. It will be noted that 6 per cent of the sheep at about 18 months had not



FIG. 195. A four-year-old mouth, all permanent incisors and teeth spreading.



FIG. 196. A broken mouth, over four years old.

lost any of their lamb incisor teeth, 84 per cent had the one pair of permanent incisors up in wear, and 10 per cent had made the change but the permanent incisors were not in wear. But 37 per cent of the two year olds and 28 per cent of the three year olds showed the usually expected dentition.

It would appear from this investigation that yearlings and four year olds are older than would be estimated from the teeth, while two and three year olds are younger than their

teeth appear from the usual schedule. Real age does not closely follow the usual order, especially in the two and three year olds. For example, 63 per cent of the two year olds and 72 per cent of the three year olds are younger than would be estimated from their teeth.

Smooth-mouthed sheep, or "gummers," and broken-mouthed sheep are discarded because of their more limited usefulness.

Abnormalities appear in the fit of the incisor teeth with the dental pad. In the normal mouth the teeth close on or immediately in front of the dental pad, according to Nordby.¹ When the lower jaw is shorter than the upper jaw and the incisor teeth strike back or inside of the dental pad, it is termed overshot mouth or "parrot mouth." With a longer lower jaw the undershot mouth condition prevails. In other words, the teeth on the lower jaw extend too far beyond the dental pad. Either of these defects impairs the grazing ability of sheep and is to be avoided in selecting breeding sheep.

¹ Julius Nordby, "Overshot and Undershot Jaws in Sheep," *National Wool Grower*, Vol. 21, No. 2, February 1931.

Chapter 31

WOOL TYPE SHEEP

All of the breeds of wool type sheep have come from the Merino, a native of Spain. From Spain fine wool sheep have spread to all of the major agricultural countries of the world, and many breeds have been founded from the original Spanish stock. In this country there have been developed the American Merino and the Delaine, and we have used extensively the Rambouillet, a French developed Merino.

The sheep of Spain had certain characteristics which made them valuable in their native land, and also to other sheep growing areas. First, a very fine wool was produced, and second, the Spanish sheep were very hardy and could travel great distances. Some of the flocks traveled from the south of Spain to the northern mountain pastures and back in a year's time. This permitted taking advantage of favorable forage and climate. The banding instinct or flocking quality became highly developed in these sheep. Shepherds could handle fairly large flocks even while traveling, as the sheep stayed close together.

The Fine Wool in America

Merino sheep that were taken to Saxony, Germany, in 1765 were as successful there as in their native home. Soon thereafter a demand arose in the United States for a wool sheep. This demand was caused in part by the Embargo Act of 1807. Between 1808 and 1816 fine wool sheep expanded greatly in numbers, and a boom for such sheep caused large importations to be made. During the War of 1812 wool sold as high as \$2.50 per pound and sheep were sold up to \$1000 per head.

Although the Merinos from Spain were first imported in 1793, it was not until 1840 that Rambouillets from France were

brought to this country. For the foundation for this breed Merinos were taken to France from Spain in 1786 and 1801.

In this country the fine wool sheep are most numerous in the western range states and certain midwestern states, notably Ohio. Rambouillets predominate in the western states; in fact, about 70 per cent of the breeding of the range sheep is estimated to be of that breed. Because the range states have heavy sheep populations, Rambouillets are the most numerous breed in this country. Texas, Utah, and Montana lead in numbers of



FIG. 197. The wool type sheep. Rambouillet rams, owned by Miss Minnie Miller, Wendell, Idaho.

Rambouillet registered; purebred Merinos (American and Delaines) are fourth of the breeds in numbers. Ohio, Texas, and Iowa rank high in numbers of these sheep. A section comprised of southeastern and east central Ohio and adjacent areas in Pennsylvania and West Virginia has a dense Merino population and is known as the tristate fine wool territory. Because of the rough land in that section the major portion of farm acreage is kept in grass.

Comparison of the Wool Type and Mutton Type

Irrespective of the fleece, there is much difference between the wool and mutton type sheep. The width, depth, compact-

ness, low-setness, and straightness of lines which typify the mutton sheep are usually quite lacking in the wool type. The fine wool sheep are narrower, more leggy and rangy than the mutton type. Low backs and drooping rumps are also more common in the wool type. More angularity of conformation is likewise typical of the wool type. Thick, fleshy conformation is



FIG. 198. A yearling Rambouillet ram, grand champion at the 1940 International Livestock Exposition. Bred and exhibited by King Bros., Laramie, Wyo.

usually lacking in the fine wool sheep while flat ribs, light loins, and light thighs are quite common. The mutton conformation as seen in the mutton type breeds is seldom duplicated in the wool type breeds, yet within this type are many which yield highly acceptable carcasses.

The fleece of the fine wool sheep is very compact as well as fine. Also the exterior of the fleece is very dark in color because of the accumulation of dirt which forms a dark, gummy material

with the yolk on the tips of the wool locks. A heavy secretion of yolk is typical of the wool sheep as are the folds or wrinkles in the skin.

Fine Wool Breeds

The wool type breeds differ in size, body conformation, and the folds and wrinkles in the skin, as well as in the character of

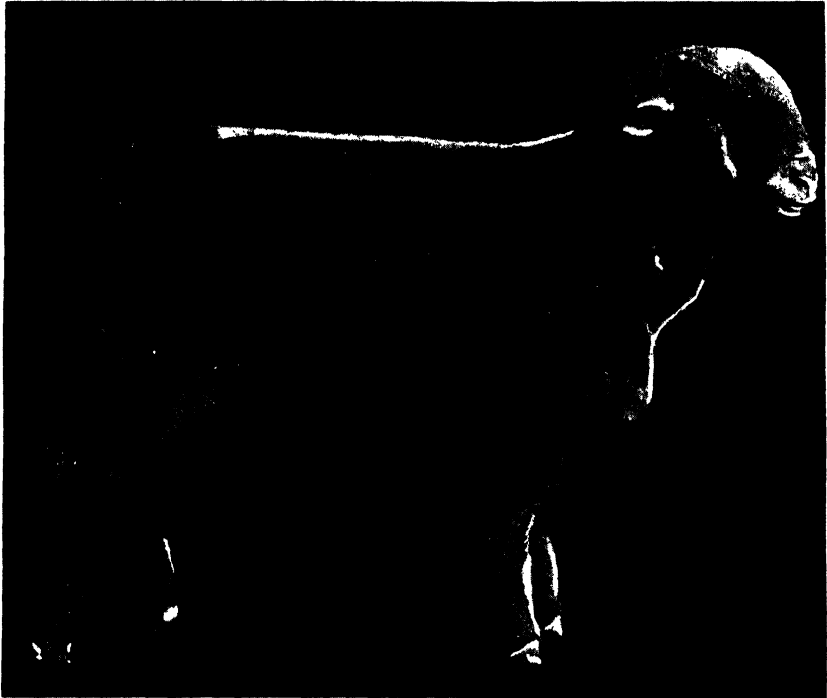


FIG. 199. A Rambouillet wether, champion at the 1939 International Livestock Exposition. Owned and shown by Purdue University, Lafayette, Ind.

the fleece. Some of the fine wool sheep are heavily wrinkled, while others are comparatively free from wrinkles. Mutton qualities have been of secondary consideration, the fleece being the main aim in the development. Yet there is within fine wool sheep much range in mutton properties.

As there is so much difference in the breeds and their characteristics and also in the ideals of the breeders, it is advisable to consider the fine wool breeds separately.

The American and Delaine Merino

The sheep first imported from Spain had a fleece fine in quality but light in weight. A ewe would shear from two to four pounds and a ram double that amount. Great progress was made by the early American breeders for the size was greatly improved, as were the yield and quality of the fleece. Vermont was a center of American Merino improvement. In a period of 40 years fleece yield was increased fourfold. Emphasis was placed upon the wool, and in some flocks the number of wrinkles on the body was increased. The mutton qualities were practically ignored.

The *Delaine* was developed in Ohio and Pennsylvania from the American Merino, and in this type of Merino the ideal was a smooth body with good mutton form, combined with a heavy fleece of good quality. These sheep yielded a fleece long enough for combing, so it could be made into cloth known as "Delaine." Consequently the sheep were named Delaine Merinos.

Characteristics of the Merino

The Merino includes sheep quite diverse in general appearance. Wrinkles or folds in the skin are qualities of the type. A single description will not fit the entire group. However, certain essentials that prevail in all of the Merinos are covered in the following discussion.

General Appearance

The Merino is rather small in size, somewhat upstanding, rangy, narrow, and angular, rather than rectangular in form. Often the backbone projects far above the shoulder blades. The back may be low, the hips high, and the rump drooping. Straight top lines are less common than in the mutton type or the Rambouillet, and there may be a lack of fullness and plumpness of such parts as the back, loin, and leg of mutton.

The head of the Merino is rather short, medium wide, and clean cut. The ewes are polled while the rams have rather large, heavy, spirally turned horns. The hair on the face, ears, and legs is white and very fine. Occasionally reddish-brown spots

appear. The skin and also the lips and nostrils are a deep pink. The masculinity of the ram head is quite pronounced, and for the ewe a feminine appearance is desirable. The neck is somewhat longer than in the mutton type and less smoothly joined with the shoulder.

The front quarter of the Merino typifies the angular conformation, as the top of the shoulder is usually high, while chest and body capacity comes more from depth than width. The chest and body may be wide in the lower part, but the body is generally narrow on top. The body is inclined to be relatively long and deep. The back and loin as well as the leg of mutton have not been the object of extreme emphasis as in the meat type sheep. As a consequence lack of width, thickness, and plumpness prevail in this part.

The legs are often faulty in conformation. They are usually too long, and often the front legs are close at the knees. The hind legs often are too close, especially at the hocks, and crooked or sickled hocks are quite common. Straight, strong, well-set legs with ample bone, strong pasterns, and well-developed, uniform feet are the ideal and are found in the more desirable individuals.

The wool completely covers the body and extends down upon the legs and over the head. There is some variation in wool covering. Under range conditions the wool covering on the head can be too heavy. Wool blindness such as results from wool growing over the eyes is a distinct detriment in range sheep. As will be noted in the detailed description of the A, B, and C types, there is a wide range in the length, density, grade, and yield in Merino sheep. The wool is in general the finest of all sheep. There may be from 10,000 to 22,000 fibers per square inch, and the diameter will range from 10 to 30 microns. The crimp is very distinct, uniform, and fine.

A, B, and C Type Merinos

At the livestock shows the Merinos are placed in three classes, A, B, and C, in the show ring classification. This classification is based upon the number of the folds and wrinkles, the character of the fleece, the size and the form.

The smoother type approaches the mutton type in form,

but of the three types it has the coarsest fleece. These types of wool sheep are described by Nordby and Beeson¹ as follows.

The A type is characterized by having heavy folds and wrinkles in the skin from the head to the tail. They have the finest, densest, shortest, and heaviest wool, which is abundant in yolk. The mutton qualities have been sacrificed for the extreme quality and quantity of wool. In comparison to mutton



FIG. 200. A champion Merino ram (A type) at the Ohio State Fair. Owned by J. Krautz and Son, Dover, Ohio.

type the A Merino is rather narrow, leggy, and lacks thickness and blockiness. In 12 months an average A type fleece will measure from $1\frac{1}{2}$ to 2 inches. The fleece grades fine clothing and is usually outstanding in quality. Good fleeces should be emphasized in selecting A type Merinos. Good type ewes will clip from 15 to 25 pounds of wool, and rams will shear 25 to 30 pounds of wool. These fleeces carry a heavy percentage of yolk, resulting in a shrinkage of 70 to 75 per cent. Mature

¹ Julius E. Nordby and W. Malcolm Beeson, *Livestock Judging Handbook*. Interstate Printers and Publishers, Danville, Illinois, 1937.

rams with a full fleece weigh from 130 to 170 pounds and ewes from 90 to 130 pounds.

The B type Merino is intermediate in the number of folds between the A and C type and also in mutton and wool qualities. They have folds on the neck, fore and hind flanks, and about



FIG. 201. A Merino ram (B type). Owned by W. M. Staley, Marysville, Ohio.

the dock. In body type they are thicker fleshed, wider, longer legged, and wider chested than the A type. Good rams shear 25 pounds and ewes 15 pounds. The wool usually grades fine Delaine with a staple measuring from $2\frac{1}{2}$ to 3 inches. The wool shrinks about 65 per cent. Mature rams weigh from 150 to 175 pounds and ewes from 90 to 140 pounds.

C type or Delaine type is free from folds on the body, has only

two or three on the neck. It is the largest of three types and has more mutton qualities, being shorter legged, wider ribbed, and heavier fleshed, with more balance and stronger constitution. The wool is not as dense on the legs and head as it is in types A and B. The best individuals have very desirable mutton qualities and make creditable meat producers. Although the wool has less crimp and density than the A and B type, it is a fleece that measures from 3 to 4 inches in length. Rams should yield 18 pounds and ewes 11 pounds of wool. Rams in full fleece should weigh from 150 to 225 pounds and ewes from 90 to 150 pounds.

Adaptability of the Merino

The Merinos of the larger size are adaptable to many conditions and they have demonstrated their ability to withstand hardships on the range. They are active and good grazers and thrive well on scant pastures. In the feed lot they make economical gains and the rate of gain is fair. They have been widely used in the southern range country and are popular in many farming areas. Ohio tests¹ have indicated that wrinkly, excessively greasy, fleeced American Merinos may have fewer wool fibers per unit of skin area than smooth bodied individuals, also that improved length of staple and great density of fiber are not incompatible.

The Rambouillet

As previously stated, the Rambouillet was developed in France and descended from the Spanish Merino. Although it was brought to this country as early as 1840 and enjoyed some popularity for a time, the interest in the breed began to wane after 1860. A revival of interest in the breed occurred following the exhibit at the Chicago World's Fair in 1893 of Rambouillets from the Baron von Homeyer flock of Germany. Many large importations followed, mostly from Germany, and the present-day Rambouillets trace to the Von Homeyer breeding about as frequently as to the sheep direct from Rambouillet, France.

¹ D. S. Bell, D. A. Spencer, and J. I. Hardy, "The Influence of Various Factors Upon the Growth and Quality of Fine Wool," *Bull.* 571, Ohio Agr. Exp. Sta., July 1936.

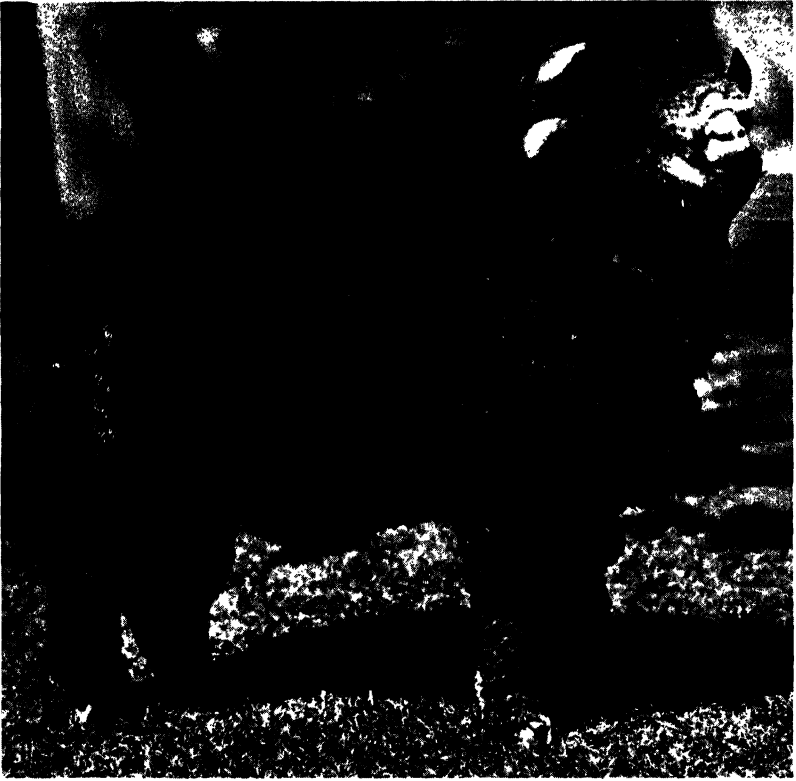


FIG. 202. A champion Merino ram (C or Delaine type) at the Ohio State Fair.
Owned by George W. Deeds, Pataskala, Ohio.

The Rambouillet is now the most popular sheep breed in this country from the standpoint of numbers.

The Rambouillet is a general-purpose breed, and, as will be noted in the score card, equal emphasis is given to mutton form and fleece. This breed thrives under farm and range conditions, and as a consequence there is no widely accepted universal standard for the breed.

The Rambouillet are large, rugged, vigorous sheep. The mature rams weigh 250 pounds and upward when unshorn, and comparable ewes weigh 150 pounds and over.¹ In form they are fairly blocky and low set, and they usually carry sufficient width, thickness, and fleshing to simulate mutton type. The rams are horned and the ewes are polled. A few polled or hornless rams are being produced. A white hair covering exists on parts not covered by the fleece.

The fleece is $2\frac{1}{4}$ to 3 inches long at 12 months, and the wool covers the entire body except around the eyes and on the nose. Open-faced sheep are preferred on the range to those with heavily wooled heads. Desirable length is associated with medium fineness. A dense fleece with a distinct crimp is desired. Ewes will shear from 10 to 18 pounds and rams from 15 to 25 pounds of grease wool. A large flock² over a period of years under range conditions had fleeces that averaged 10.60 pounds in the grease, 2.33 inches in length, and 61.05 in spinning count. A desirable fleece will have a fiber diameter of from 5.5 to 6.5 ten-thousandths of an inch (about 14 to 16.5 microns) and a density of 34,000 fibers per square inch.

Rambouillet Score Card

J. M. Jones³ has formulated a score card for Rambouillet sheep for the purpose of defining concisely the generally accepted sheep of the A and B type Rambouillet sheep. The score card follows.

¹ In a study of size and production of fine wool ewes, W. E. Joseph of Montana found that size was the best single measure of the ability of ewes of the fine wool type to raise heavy lamb crops. None of the ewes weighing 100 pounds or less in their mature form produced lamb crops that weighed above the average for the entire group, and most were distinctly below the average. (*Bull.* 242, Montana Agr. Exp. Sta., March 1931.)

² D. A. Spencer, J. I. Hardy, and Mary J. Brandon, "Factors That Influence Wool Production with Range Rambouillet Sheep," *Tech. Bull.* 85, U.S.D.A., 1928.

³ J. M. Jones, "Getting Together on Rambouillet Types," *The Cattleman*, March 1931.

DETAILED SCORE CARD FOR REGISTERED RAMBOUILLET SHEEP

Definition of Types:

B type: A B type Rambouillet shall carry preferably three prominent, symmetrical folds under neck, one or more of which extends prominently over top of neck; one or more distinct folds on front or rear or both flanks; one or more on sides with one or more folds on thighs and around dock or tailhead.

C type: A C type Rambouillet may be either free from folds or show as many as three well-developed symmetrical neck folds, none of which shall extend prominently over the top of the neck, other parts of body being free of any prominent folds.

Sex..... Type..... Date Born..... Sire.....
Dam.....

		Perfect Score	Actual Score
Body:			
1. General Appearance and Breeding: Stylish and active; free from "choppy" skin folds; symmetrical in outline and showing desirable mutton conformation especially in C type; rams strongly masculine; ewes distinctly feminine; plenty of development (age considered).....		10	.....
2. Head: Strongly masculine (ram); medium length; forehead, broad; wide between ears, proportion to body. (Ewe) distinctly feminine in character; refined, proportionate to body size.....		2	.....
3. Face: Silky hair free from coarse chalk hair or kemp; broad nose in rams; well-developed muzzle; lips thick, pink in color and free from dark spots; nostrils large; under- or overshot jaw should disqualify.....		4	.....
4. Horns: (Horned strains of rams) well developed, with distinct corrugations; widespread so they will not press or pinch neck or jaws. In polled strain, absence of scurs or knobs desirable.....		2	.....
5. Eyes: Large, alert, prominently set; eyelashes light color; rolled-in eyelids and lashes objectionable; unobstructed vision desirable.....		3	.....
6. Ears: Broad, thick, and relatively short; velvet or silklike covering.....		1	.....
7. Neck: Medium length; blending neatly with head and shoulders; not more than three well-defined symmetrical skin folds under neck; these preferably not extending prominently over top of neck on the smooth type of sheep.....		3	.....
8. Chest: Deep and broad.....		3	.....
9. Withers: Fairly well rounded; not too far apart or too prominent.....		1	.....
10. Top line: Straight with no drop in front of or behind withers, and well carried out at rump.....		4	.....
11. Back: Medium length, fairly broad, loin wide, blending smoothly with hips.....		5	.....

DETAILED SCORE CARD FOR REGISTERED RAMBOUILLET
SHEEP—(Continued)

<i>Body (Continued):</i>	<i>Perfect Score</i>	<i>Actual Score</i>
12. Ribs: Well sprung and preferably well rounded out, assuring ample capacity for vital organs.	2	.....
13. Rump: Long, wide, and level, carrying width nicely to dock; tail neatly docked.	2	.....
14. Leg of Mutton: Well filled out, twist deep.	2	.....
15. Scrotum: (Ram) Enveloping two normally developed testicles; udder (ewe) sound and well developed. Ridgling character in rams disqualifies.	1	.....
16. Legs: Medium length, straight, strong, free from off-colored hair markings, pasterns strong; hoofs amber color and free from excess of pigmentation.	5	.....
Subtotal.	50	.....

Fleece:

1. General Appearance of Fleece: Attractive and even; carrying dense fleece of high yielding staple wool (12-month basis); light to medium covering on face; forehead covered but not woolled sufficiently around eyes to obstruct vision; wool covering extending on legs nearly to hoofs; free from objectionable fibers.	8	.....
2. Length of Staple: (12-month basis) Approximately uniform length over body; including belly covering; minimum area in flanks and armpits uncovered; should be staple length (2½ inches).	12	.....
3. Fineness and Quality: Well-defined even crimp extending from base to tip with uniformity in diameter over greater portion of body; soft and pliable to the touch; bright attractive color; sound throughout; free from kemp with minimum showing of unevenness of wool covering on folds; free from off-colored or other undesirable fibers.	15	.....
4. Density of Covering: Even, compact, or slight wavy tip; clean or free from foreign materials (an open fleece is indicated by open, ropy locks with dirt, sand, and other foreign particles penetrating almost to the skin along the top line, and also large uncovered area in flanks and armpits); belly wool with medium density and of staple length appears to be reliable indicator of density and high yielding qualities.	10	.....
5. Condition: Yolk moderate, preferably light to creamy in color and evenly distributed; heavy, dark, clotted yolk objectionable; only minimum amount of sand, dirt, vegetable matter and stained locks.	5	.....
Subtotal.	50	.....
Grand Total.	100	.....

A comparison¹ of the fleeces of C and B type Rambouillet ewes indicates that the B type produced about one pound more of unscoured wool than the C's, but much of the difference was in the shrink. The C type had greater staple length and contrary to common opinion the wool was finer than the B type. The C type also produced more desirable feeder lambs.

Adaptability of the Rambouillet

In the range sheep sections today the term "fine wool" has come to mean only one breed, the Rambouillet, according to Hultz and Hill.² The foundation of most range flocks is fine wool breeding. Rambouillets have been increasing in Texas, once a Merino stronghold. As the market advantage swings from wool to lamb and reverse, some of the western sheep raisers switch to rams of the mutton breeds like the Hampshire, Corriedale, Lincoln, Cotswold, or Romney Marsh and then to the Rambouillet, in compliance with the demand. The Rambouillet is preferred in the breeding of the range ewes because of its tight fleece, banding instinct, grazing qualities, hardiness, and general adaptability. In farm flocks and as feeders in the corn belt and elsewhere the Rambouillet has proved its worth.

Crossbred Wool Type

The Corriedale, which was developed in Australia and New Zealand, is the most common breed in the crossbred wool class. This breed, which came from using Lincoln, Leicester, and Romney Marsh rams upon Merino ewes, has become quite numerous in this country as the sheep are popular on the range. They excel the Rambouillet in mutton conformation and length of fleece.

In this country we have developed some breeds of this general classification. The Columbia was developed from Rambouillet rams and Lincoln ewe crosses. The reverse cross, that is, Lincoln rams and Rambouillet ewes, was used for the foundation of the Panama breed. The Romeldale breed is also of crossbred

¹ Jones *et al.*, *A Preliminary Comparison of Fleeces from B and C Types Rambouillet*. American Society of Animal Production, 1931.

² Fredric Hultz and John A. Hill, *Range Sheep and Wool*, Wiley, New York, 1931.

foundation, as Romney rams and Rambouillet ewes formed the basis. The Targhee, also a new breed, is based on a combination of approximately three-quarters Rambouillet and one-quarter Lincoln breeding. The breeds developed from these crosses have fine wool fleeces of longer staple than the Rambouillet. They also have quite acceptable mutton conformation.



FIG. 203. A champion Corriedale ram and ewe. Bred and exhibited by King Bros., Laramie, Wyo.

Influence of Various Factors upon the Growth and Quality of Fine Wool

Many of the factors that supposedly affect wool growth have been studied on fine wool sheep in Ohio.¹ This investigation showed that stage of wool growth exerts only a slight influence, if any, on the rate of growth of wool fiber on Merino sheep under a good system of feeding and management. This coincides with other investigations, which indicate that if disease is controlled and a natural environment is maintained the growth of wool in length is quite uniform through the year and up over five years of age, and growth is not influenced by shearing. The rate of growth of wool in the Ohio observations is subject to accelera-

¹ D. S. Bell, D. A. Spencer, and J. I. Hardy, "The Influence of Various Factors Upon the Growth and Quality of Fine Wool as Obtained from Merino Sheep," *Bull* 571, Ohio Agr. Exp. Sta., July 1936.

tion or diminution by outside influences, such as seasonal condition of feed supply and the process of weaning and starting milk flow.

Sex, pregnancy, and age did not seem to influence the rate of



FIG. 204. Examining the fleece. A purebred Rambouillet ewe owned by U.S.D.A., Western Sheep Breeding Laboratory, Dubois, Idaho. Weight 145 pounds in range condition, length of staple $2\frac{1}{2}$ inches. Note the freedom from wool about the eyes or open face. (Photo from J. E. Nordby.)

growth of wool fiber. Breed influenced the total yearly growth, also the periodic growth, and was related to the effect of outside influences such as feed and other factors. American Merinos and Tasmania Merinos were used in these tests, and the former proved superior to the latter for that region.

Chapter 32

SHEEP MARKETS

MARKETING SHEEP

In marketing their product, sheep raisers in general have available the same methods of disposal as cattlemen, and sheep are handled much the same way as cattle. As sheep raising is of a different pattern than cattle raising (compare Figures 6 and 182), the market movement is not entirely the same. The western states have the largest numbers of sheep, which in marketing pass eastward toward the centers of human population. Also, lamb and mutton consumption is the heaviest in the eastern states on a per person basis. Over 80 per cent of the lambs raised are raised west of the Mississippi River, while 78 per cent of the lamb is consumed east of the Mississippi. Lamb and mutton travels farther from the surplus producing regions of the west to the deficient areas in the east than beef, and pork is produced nearer the consumer than beef. The distance from the center of sheep raising to the center of human population is 850 miles.

Methods of Marketing

It is common to designate the marketing method, as direct or indirect. A sale from a grower to a feeder or a packer is direct, because the transfer of ownership is made without making use of a public stock commission agency. Sales made on public stockyard markets are indirect transactions, as the owner is represented by an agency.

The percentage of the slaughter sheep that are sold directly to the slaughterers declined from the period of 1923-1928, at which time it amounted to about 15 per cent of the total. Following 1928 there was a gradual increase in the directs until 1932, and since that time the increase has been irregular but rather

rapidly upward. In 1939, 34 per cent of the sheep and lambs slaughtered by packers were purchased direct. There has also been an increase in the direct movement of feeder sheep as

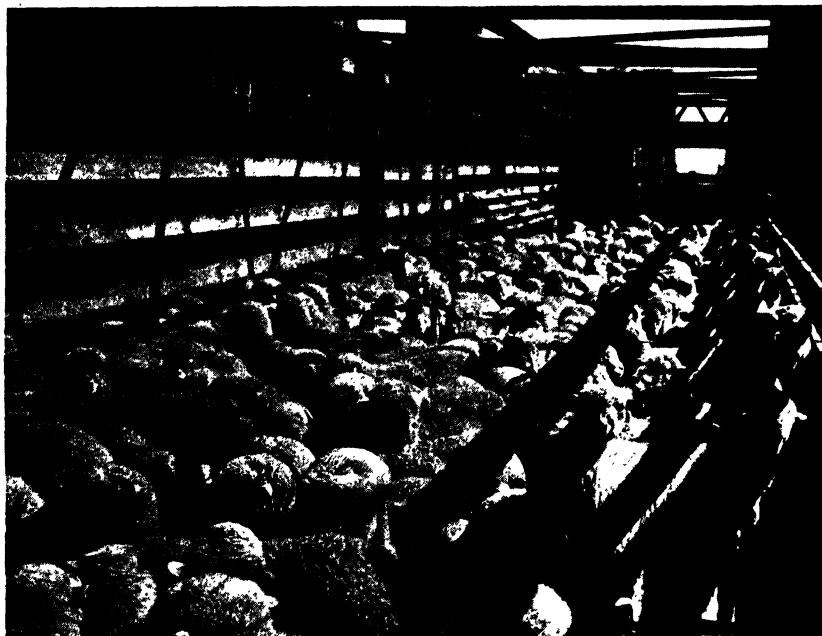


FIG. 205. Sheep at the stockyards. A band of lambs being moved in an alley of the Union Stockyards, Chicago, Ill.

indicated by the decrease in the shipments of feeder sheep from the public markets. Following is a tabulation by periods of the shipments for feeder sheep and lambs from public markets.

SHIPMENTS OF FEEDER SHEEP AND LAMBS FROM
63 PUBLIC MARKETS—YEARLY AVERAGE

<i>Period</i>	<i>Thousand Head</i>
1920-1924	4319
1925-1929	4895
1930-1934	3898
1935-1939	3110

As feeding of sheep and lambs has been on the increase, it is apparent that the direct movement has increased. For the year 1939, 32 per cent of the feeder and stocker sheep received in the corn belt states were from public stockyard markets, while 68 per cent were direct.

Leading Sheep Markets

Chicago and Denver are the leading sheep markets on the basis of total receipts. Denver had the advantage in the last half of the 1930 decade, but for the entire decade Chicago led in aggregate number of sheep receipts. It appears that Chicago receipts are declining while those at Denver have shown an upward trend. A smaller number of feeder and stocker sheep and lambs have been passing through the Chicago market and an increased proportion have been sold direct. The rank of markets on the basis of receipts, which of course fluctuate materially from year to year, is continually changing. The shifting of production areas and also the feed conditions in the areas served by a market affect its receipts. Reshipments for slaughter and feeding are discussed later.

The leading sheep markets and their yearly receipts based on a ten-year period are as follows.

LARGE CENTRAL MARKETS FOR SHEEP
Average Yearly Receipts for the Ten-Year Period,
1930-1939¹

<i>Market</i>	<i>Average Yearly Receipts, Thousand Head</i>
Chicago	3014
Denver	2840
Omaha	2164
Ogden	2068
Jersey City	1669
Kansas City	1652
South St. Paul	1322
St. Joseph	1105
Pittsburgh	1100
Forth Worth	903
Buffalo	831
Sioux City	802
East St. Louis (National Stockyards)	759
North Salt Lake City	616
Indianapolis	399

Seasonal Variation in Sheep Receipts

There is a marked seasonal variation in the marketing of sheep and lambs. The low point in receipts, in February and March, is followed by a rise in April and May. A dip in

¹Data from Agricultural Marketing Service, U.S.D.A. Source: *The Drovers' Journal Yearbook of Figures*.

receipts occurs in June, followed by rapid rise in the late summer, continuing on until October, which is the peak month in receipts. This seasonal variation may be noted in Figure 206.

Origin of Market Receipts of Sheep by Months

There is considerable variation in the marketing season for sheep and lambs from various states, as is shown in Figure 206. The California lambs are the first to appear upon the markets, and they are nearly all marketed in April and May. The southern lambs from the corn and wheat belts closely follow or

SHEEP AND LAMBS: ORIGIN OF MARKET RECEIPTS BY MONTHS

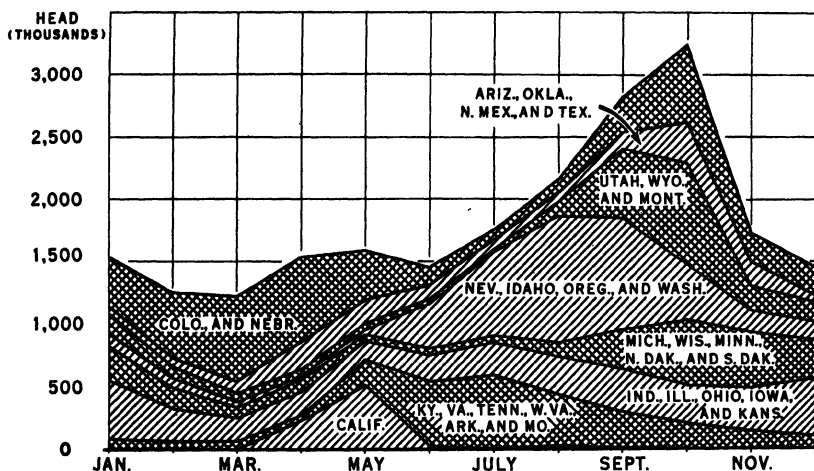


FIG. 206. The marketing of sheep and lambs is seasonal. Also the marketing season varies for the different states. (U.S.D.A., Bur. of Agri. Economics.)

overlap with the California lambs. Then the range lambs start moving to the markets. This is climaxed in October, which is the end of the mountain pasture feeding. From May to November grass lambs comprise the bulk of the marketing. Fed lambs make up the major portion of the receipts from January to April, and these come from the lamb feeding areas of Colorado, Nebraska, Kansas, and the corn belt states.

Feeder Sheep on the Market

Many of the lambs coming to the market are insufficiently finished to be highly acceptable to the meat packers. These

lambs and also a few sheep older than lambs are classed as stockers and feeders, and are reshipped to the feed lots for feeding. For the ten-year period 1930-1939, about 54 per cent of the feeders went to the corn belt states. Heavy winter lamb feeding is also practiced in Colorado, Nebraska, and Kansas. On January 1 of each year these are listed as lambs and sheep on feed to distinguish them from stock sheep.

The movement to the country from the public markets is very heavily peaked in the fall, especially in October and September. This movement coincides with the marketing of the lambs from the range country before inclement weather begins.

Leading Markets for Feeder and Stocker Sheep

The leading public markets for feeder and stocker sheep are much the same as the markets of the maximum or total receipts, as the total receipts include those reshipped for feeders. The larger proportion of feeders in the receipts will be found on the western markets or those nearest the western range.

Following is a listing of the larger feeder sheep markets and their average shipment per year for the ten-year period 1930-1939.

LARGE CENTRAL MARKETS FOR FEEDER SHEEP

Average Yearly Receipts for the Ten-Year Period,
1930-1939 ¹

<i>Market</i>	<i>Average Yearly Receipts, Thousand Head</i>
Denver	773
Omaha	496
Ogden	479
Kansas City	235
Sioux City	219
Pueblo	200
Chicago	195
South St. Paul	181
North Salt Lake City	168
St. Joseph	158
Fort Worth	142

Shrinkage in Shipping

The weight loss between the home weights and the sale weights at the market, or shrinkage, is a factor in marketing

¹ Data from Agricultural Marketing Service, U.S.D.A. Source: *The Drovers' Journal Yearbook of Figures*.

costs. Sheep shrink more heavily in transit than cattle or hogs. Actually, as sheep are fed and watered at the yards before selling and weighing, some of the shipping loss is regained. This is called "fill."

Shrink varies with the length of time and other conditions in the shipping. Shrinks are greater in the spring and summer than in the fall and winter. Following is the usual shrink which occurs with somewhat average circumstances for the conditions specified. An example is given for a 90-pound lamb.

	<i>Shipped by Truck</i>	<i>Shipped by Railroad, Miles</i>			
	<i>50 Miles or Less</i>	<i>100</i>	<i>400</i>	<i>1000</i>	<i>2000</i>
Percentage shrink	3	4	5	7	10
Weight of lamb at market with a home weight of 90 pounds	87.3	86.4	85.5	83.7	81.0

A 90-pound lamb at home selling for \$10.00 per hundred-weight would bring \$9.00. With a 10 per cent shrink in weight, the lamb would have to sell for \$11.11 per hundredweight to bring \$9.00.

Transportation to the Market

Sheep are shipped to the market less by truck "drive-ins" than hogs or cattle. On 65 public markets, 32 per cent of the sheep and lambs arrived by truck in 1939, whereas 58 per cent of all of the livestock were delivered to the markets by motor truck. Sheep and lambs are generally shipped farther than hogs and cattle, consequently rail shipments still predominate. The receipts are divided into rail and "drive-ins." The latter group is received mainly by truck.

Number of Sheep and Lambs per Railroad Car

To prevent losses from death and bruising, it is essential that sheep like other livestock be not too crowded in the car. Underloading is also objectionable, and if the sheep have too much space in the car a partition to shut off the excess space will reduce bumping around en route to market. Double

decking is practiced with sheep, and usually the upper deck is less heavily loaded than the lower deck. The number of sheep or lambs of various weights to load in a car is given in the tabulation which follows.

SHEEP AND LAMBS PER RAILROAD CAR PER DECK¹

<i>Average Live Weight</i>	50	60	70	80	90	100	110	120	130	140	150	160	170	180
36-ft. car	155	143	131	120	112	105	101	97	93	89	85	81	78	75
40-ft. car	170	156	143	133	124	116	111	106	102	98	94	90	86	83

Shipping Losses

A study of the dead and crippled sheep and lambs arriving by railroad and truck at Kansas City, St. Joseph, Omaha, Sioux City, and St. Paul public stockyards by the National Livestock Loss Prevention Board shows the following percentage of dead and crippled.

<i>Animals Shipped</i>	<i>Per Cent Dead</i>		<i>Per Cent Crippled</i>	
	<i>Rail</i>	<i>Truck</i>	<i>Rail</i>	<i>Truck</i>
Sheep and lambs	0.054	0.264	0.026	0.131

The study was based on a five-year period 1935-1939. The higher rate of dead and crippled in truck shipments was due in part to poor loading conditions and improper handling. Trucking of livestock is comparatively new and not as well supervised as rail shipment, consequently the damage in loading and en route is higher than in railroad shipments.

MARKET DIVISIONS OF SHEEP

On the sheep markets there is a considerable amount of sorting into the market classes and grades. A standardization of such divisions makes possible more accurate reporting of the market and gives the producer a more accurate picture of

¹ Swift and Co., *Bull.* 20, May 1941.

demand. Likewise market standards make possible a more accurate determination of value and permit trading without personal inspection.

Cattle are more completely sorted than sheep on the livestock market, yet the latter are divided into lots for sale more than hogs. Mixed loads of lambs and sheep on the public market are quite generally sorted into salable packages or lots, and often a buyer sorts the lot further before final acceptance.

Principal Uses for Market Sheep

Sheep received on any public livestock market or sold direct are either sold to packers or bought by feeders or farmers for further feeding or for breeding purposes. These divisions are based upon the suitability of the individuals for the purpose specified and the demand for each class. Thin or unfinished lambs and sheep usually are reshipped from the market for further feeding and those finished sufficiently are purchased by slaughterers. However, borderline individuals or two-way sheep go to satisfy the greatest demand.

Place of Origin

Quite generally on sheep markets receipts are designated by the region or state of their origin. Thus we hear of western sheep which come from the range and "native sheep" which originate from farm flocks of the midwest, east, or south. We also hear of "Montanas," "Idahos," "Wyomings," "Colorados," etc. Although these terms at one time may have been meaningful, at present the sheep from one section or state are not uniform. Western sheep, for example, used to be mostly "white faced" of fine wool breeding, and range reared. The sheep of that area have changed as new breeds were introduced and feeding practices changed. Consequently descriptive terms based upon the place of origin have lost much of their former significance.

Classifying and Grading Sheep and Lambs

The object of the classing and grading or the sorting process is to form groups of animals that are similar.

Classifying then is divided into the major subdivisions known

as "classes, subclasses, age, and weight." The classes and subclasses are based upon sex or sex condition and use, while age and weight are used for further division.

Grading or the final separation results in smaller, more uniform lots than classifying. Commonly on the market grading is used to designate both classing and grading. The grade is dependent upon form, quality, and finish. The higher grades, for example prime lambs, are nearly ideal in form, quality, and finish.

Market Classes and Grades of Sheep

Following is a tabulation of the market classes and grades which may be on the market.

	<i>Basis for Grouping</i>				
	<i>Sex Classes</i>	<i>Age Divisions</i>	<i>Use Selections</i>	<i>Weight Divisions</i>	<i>Grades</i>
Divisions in each group	Ewe Wether Ram	Hot-house lambs Spring lambs Lambs Yearling 2 and 3 years 4 years and older	Slaughter Feeding Breeding	Light Medium Heavy Handy Mixed	Prime or fancy Choice Good Medium Common Cull or inferior

When woolled and shorn sheep or lambs are on the market, this is a further basis for division.

Definitions and Descriptions of Market Groups¹

The term "sheep" includes ovine animals of all ages. In practice, however, this species is divided on the basis of age into two groups, sheep and lambs. Lambs include those approximately one year of age and younger, and sheep include all those about one year of age and older.

A *ewe* is a female sheep.

A *wether* is a male sheep which was castrated before it had reached sufficient maturity to make reproduction possible and has not developed male characteristics. As a rule, castration is done before the animal is six weeks old.

¹From "Market Classes and Grades of Lambs and Sheep," *Circ.* 383, U.S.D.A., March 1936.

A *ram* is an uncastrated male sheep.

Slaughter animals are those possessing sufficient fat or finish to meet the requirements of the consuming trade. This designation covers all animals which will produce meat that is wholesome and fit for human food. Any such animal may be slaughtered and consumed.

Feeders are animals which lack sufficient finish to produce the highest grades of meat but which show evidences, as a rule, of ability to take on additional flesh and fat economically, most of the gain resulting from additional fat or finish rather than growth.

Shearer is a subclass of lamb denoting animals that are in full fleece and that are purchased primarily for their wool. Such lambs, as a rule, either are fat or are in higher flesh condition than most feeders and they usually have longer wool. They are taken to feed lots and shorn, then after a brief feeding period are returned to the market for resale.

Breeders are sheep or lambs sold for breeding purposes. As a rule transactions in breeding sheep at the public markets are confined to females of the species, and ordinarily not many ewe lambs are sold for this purpose. Most of the breeding ewes sold at the market are relatively young ewes from range bands. They possess good conformation and quality and show evidence of improved breeding.

A *lamb* is a young ovine animal which has not yet acquired its first pair of permanent incisor teeth. The age at which this occurs varies in individuals from around 10 to 15 months. As the animal approaches the yearling stage, therefore, it is sometimes necessary to inspect the mouth to determine whether it is still a lamb. If it has not yet acquired its first pair of permanent teeth, it is considered a lamb. Ewe and wether lambs, as a rule, produce carcasses that are similar, therefore buyers do not differentiate between them. At many of the leading markets, however, ram lambs are discriminated against because they show the influence of sex development, especially if they are more than four or five months of age. They tend to develop thicker necks and slightly broader and heavier shoulders than do the ewe and wether lambs. The differences between the two in this respect are seldom sufficient to justify separate descriptions.

Hothouse Lambs. A hothouse lamb is a very young animal that has been raised, as a rule, in confined quarters and has received an abundance of its mother's milk during the short period of its life. Both the lamb and its mother receive special care so that maximum growth and finish may be attained, since most hothouse lambs are marketed at six to ten weeks of age. Such lambs are usually marketed during the period from Christmas to the Easter holidays through wholesale houses or direct on order at weights ranging from 30 to 60 pounds.

Spring Lambs. "Spring lamb" is a term generally applied to new-crop lambs that come to market in the spring of the year. It is used to distinguish them from old-crop or fed lambs that were born the previous year. In market practice the term "spring" is dropped on July 1 and the more common term "lamb" is used.¹ At the same time the old-crop lambs are classified as yearlings. On account of varying climatic conditions in different sections of the country, however, lambs produced in a manner similar to those called "spring lambs" previous to July 1 arrive at some markets throughout the summer and early fall.

Spring lambs are those generally ranging from three to seven months in age which have run with their dams from birth and derived a large part of their food therefrom. Since the spring lamb is older than a hothouse lamb, the wool is longer. The body is slightly deeper and wider in proportion to its length, and is less cylindrical than that of the hothouse lamb. The face is somewhat longer and the eyes, nostrils, mouth, and ears are relatively larger. As compared with older lambs, however, the spring lamb is relatively small, and its wool is shorter than that of one approaching the yearling stage. This gives it a decidedly youthful appearance. Spring lambs weighing from 70 to 90 pounds are in most demand.

Lambs. During the latter part of the summer and early fall, the lambs coming to market show less and less the effect produced from subsisting largely on milk and more and more that of having subsisted on feed other than milk. This group includes those that are older and more fully developed than spring lambs. They range in age from approximately 7 to 15

¹ On some markets this change is made June 1.

months, but the bulk are from 8 to 12 months old. Those that approach the yearling stage show greater maturity in all respects than do spring lambs. As a rule, they are relatively wider and deeper in body and more heavily fleshed. The wool is longer and slightly darker in color owing to greater exposure to weather and dirt. The head and face are longer and show greater maturity around the mouth, eyes, and ears. Included in this group are the so-called "fed lambs" marketed during the winter and early spring.

Other Factors That Affect Market Value

Three factors other than grade factors affect the market prices of sheep and lambs. These factors are weight, excessive finish, and yield.

WEIGHT

Weight is an important price factor in both sheep and lambs, but it is especially important in lambs. As a rule, heavy sheep and lambs are in less demand at the markets than animals of lighter weight.

Slaughter lambs that weigh 70 to 90 pounds usually are preferred, and they bring a higher price per pound, grade for grade, than do those weighing more than 90 pounds. This difference in price is based on demand and is largely the result of consumer preference for small or medium-sized cuts. Slaughter ewes that weigh 90 to 120 pounds are in relatively greater demand than those weighing over 120 pounds. Because of the rather limited demand for the heavier ewes, most of which are considered by the trade to be too fat, they usually sell at prices considerably below those of the lighter ewes.

EXCESSIVE FINISH

"Overfat," "wasty," and "excessive" finish are terms frequently used in the wholesale meat trade, when referring to carcasses that have a very large amount of fat in proportion to lean. This condition is more frequent with heavyweight ewes and wethers, but it sometimes occurs with lambs, especially those that have been fitted for show purposes.

CARCASS YIELD

Carcass yield, or the carcass weight in relation to live animal weight, is another element that affects the price of slaughter sheep and slaughter lambs.

Since the meat of the animal is its principal commercial product, the number of pounds of carcass the slaughterer obtains from each 100 pounds of live weight is a matter of real consequence and determines to a considerable extent the price of slaughter lambs. For that reason, yield often is considered by some as a grade factor. Under certain conditions yield is closely related to grade, because, as a rule, higher yields are obtained from the better grades while low yields and low grades are closely associated. Other factors affecting yield are weight of pelt and amount of fill.

Weight of pelt varies greatly among animals of the same grade, depending on type of breeding, length of staple, and quantity of foreign material it contains. All these factors influence the total weight of pelts, which greatly affects the carcass yield. As a rule, weight is of much greater importance than the quantity or grade of the wool. At times when wool prices are high the price of slaughter lambs is influenced by both the wool and carcass yield. The pelts from the fine wool type sheep usually weigh more than those from the mutton type sheep because of the heavier fleece and thicker skin that is characterized by folds or wrinkles.

Carcass yield also is influenced by the fill or quantity of feed and water an animal consumes after it arrives at the market. This varies somewhat with the method of transportation, time in transit, and distance trucked or shipped to market. Lambs that have been hauled relatively short distances by truck show evidences of greater fill than those which have been shipped long distances by rail.

Different Market Classifications

There is a wide variation of classification in use at different sheep markets; in fact, on a given market there may be much variation in the classing and grading. The official grade standard is used as a basis for the market news service of the U. S.

Department of Agriculture. Market reports by private live-stock marketing agencies in many respects do not conform with the official standard, which is optional.

The following schedule shows in a condensed form how lambs and sheep are divided in market groups according to the official standard, as to classes, subclasses, age, weight, and grades.

LAMB AND SHEEP SCHEDULE

Class	Subclass	Age Selection	Weight Selection, Pounds				Grades
			Light	Medium	Heavy	Regular or Handy	
Lambs	Slaughter	Hothouse				60-down	Fancy, choice, good, medium, plain
Lambs	Slaughter	Spring				90-down	Prime, choice, good, medium, plain, cull
Lambs	Slaughter	Lambs	70-down	80 to 90	90-up	70 to 80	Same as spring lambs
Lambs	Feeder	All	All weights				Fancy, choice, good, medium, common, inferior
Lambs	Shearer	All	All weights				Choice, good, medium
Ewes	Slaughter	Yearling	90-down	90-100	100 up		Same as slaughter lambs
Ewes	Slaughter	2 yr old or over	100-down	120-140	140 up	100-120	Same as slaughter lambs
Ewes	Feeder	All	All weights				Choice, good, medium, common, inferior
Ewes	Stock or Breeding	Yearling 2 and 3 years 4 years or older	All weights				Fancy, choice, good, medium, common
Wethers	Slaughter	Yearling	90	100-110	110 up	90-100	Same as slaughter lambs
Wethers	Slaughter	2 yr old or over	100	115-130	130 up	100-115	Same as slaughter lambs
Wethers	Feeder	Yearling	All weights				Same as feeder lambs
Wethers	Feeder	2 yr old or over	All weights				Same as feeder lambs
Rams	Slaughter	Yearling	All weights				Good, medium, common
Rams	Slaughter	2 yr old or over	All weights				Good, medium, common

In this schedule the grade may be given in numbers and letters. Following are grade terms and their equivalent number grade.

Prime or Fancy	AI
Choice	1
Good	2
Medium	3
Plain	4
Inferior or Cull	5

A detailed description of the grades in all the individual classes is deemed unnecessary. The successive grades are merely less acceptable in the grade factors conformation or form, quality and condition or fleshing. Some of the better grades will be described.

PRIME OR AI GRADE OF SLAUGHTER LAMBS

A prime or AI grade slaughter lamb (see Figure 207) has excellent conformation, finish, and quality, and is comparable to a top mutton lamb as described in Chapter 30. Following is a brief description of such lambs.

CONFORMATION

The body is very compact and symmetrical. It is very deep and wide in proportion to its length. All parts are fully developed, producing a very smooth and even body outline. The flesh over all parts of the body is very thick, giving it a plump and well-rounded appearance. The back, loin, and rump are very wide. The leg of lamb is large and plump, and is full and low in twist. A prime lamb has a uniform, straight-lined middle. The crops are very full and the shoulders are very thick, blending smoothly into the body. The neck is thick and very short.

FINISH

The fat covering is thick, but not excessive, and extends well over all parts of the body. It is very firm and smooth, and evenly distributed. The fat covering over the back, ribs, and loin almost entirely conceals the bones from the touch.

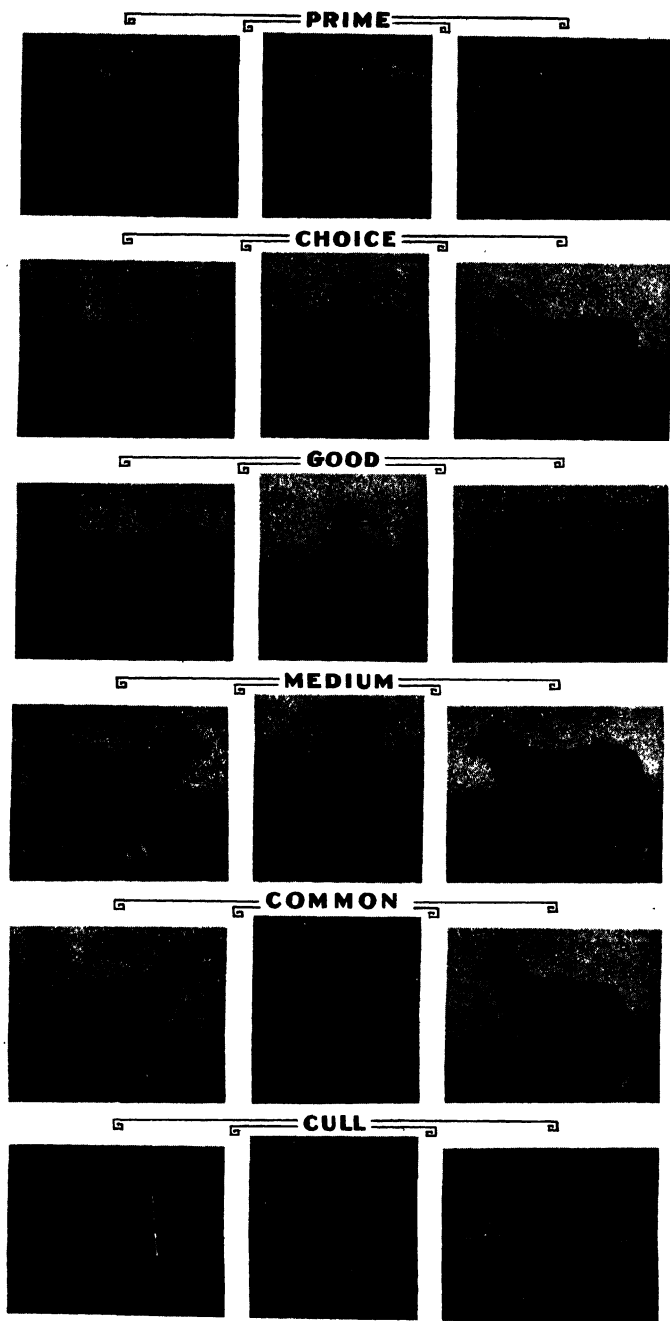


FIG. 207. United States Grades of Slaughter Lambs. U.S. Dept. of Agriculture. Agricultural Marketing Service.

QUALITY

A prime grade lamb has excellent quality. It is very smooth and firm in all parts of the body. It has a refined, medium-sized head and rather small leg or cannon bone. The shoulders are smooth and are even in width with the rest of the body. The proportion of flesh to bone is very large. Such a lamb is usually of mutton type. The thick, evenly distributed finish over the body indicates a generous supply of fat throughout all parts of the carcass. These characteristics generally indicate a very high degree of quality in the flesh.

Fancy or A1 Grade Feeder Lamb

A fancy or A1 grade feeder lamb has superior conformation, finish, and quality.

CONFORMATION

The body is compact and very symmetrical. It is wide and deep in proportion to its length. The flesh over all parts of the body is thick. The back, loin, and rump are wide. The leg is large and is full in the twist. The middle is uniform in width and depth with the shoulders and hips. The crops are full, and the shoulders are smooth and about the same width as the rest of the body. The neck is very short, and the head is medium in size.

FINISH

The fat covering is smooth and is evenly distributed over the body but in feeders it is scant.

QUALITY

The fancy grade lamb has excellent quality. The skin is thin and smooth. It has refined, medium-sized head and bone and the shoulders are smooth. Such a lamb is usually of mutton type and has either purebred or crossbred markings.

Breeding Sheep

It will be noted in the sheep and lamb schedule that breeding sheep are also included. Some sheep on the markets go out

into the country to form breeding flocks. This is but a very small part of the market sheep and is comprised mostly of ewes. Although ewes acceptable for the breeding flock may be found on a sheep market, rams on the large market are scarce and usually of inferior conformation. The ewes culled from range flocks if not broken mouthed or "gummies" may be purchased



FIG. 208. Receiving sheep at the stockyards. Sheep delivered by truck are classed as "drive in." This category includes all sheep received by other means than rail. (Swift and Co.)

by farmers in the middle west and used for one or two crops of lambs.

- Ewe lambs are seldom taken out as breeding sheep because the kind in demand for this purpose are ewes that can immediately go into the breeding flock. The trade is quite seasonal as the heaviest demand is just before the breeding season which is in the fall of the year. Ewe lambs would for the most part have

to be kept over until the second fall for breeding. Ewes suitable for breeding are available in the largest number in the fall. Slaughter competes strongly for the younger ewes which could go into breeding flocks. The following subclasses and grades are common in market breeding ewes.

<i>Breeding Ewes</i>	<i>Grades</i>
Yearling	Fancy
Two and three years old	Choice
Four years old and over	Good
	Medium
	Common

Fancy breeding ewes are the top grade, and there are relatively few of this kind available. In form such ewes must meet the requirements for a top breeding ewe. (See page 622.) Well-bred ewes are preferred. They must be good-sized, uniform, stylish, of good quality, and have good fleeces.

The lower grades fall short of the top grade in some of the essential qualities, and the lowest grade (common) is quite inferior.

Trimming Lambs for Market

DOCKING LAMBS

It is usually advocated that all lambs should be docked when one to two weeks of age. Docked lambs are cleaner and are generally more easily kept free from maggots. Also, docked lambs are more attractive in appearance.

CASTRATION OF LAMBS

Early castration of the male lamb is also advocated. In fact, it is usually done at the same time as docking. In a very



FIG. 209. Improper handling in loading sheep. Lifting sheep by the wool pulls the skin away from the flesh, causing damage to the carcass. (Harry J. Boyts, National Loss Prevention Board.)

young lamb the presence of the testicles would not detract from the quality of the meat. Usually the discount on the markets in the native sheep states on ram lambs as compared with ewes and wethers becomes effective between May 1 and June 1 and becomes greater as the season advances. A ram lamb under 75 pounds in weight is not very "bucky" in appearance, and the secondary sexual characters up to that size have not shown any appreciable development.

An investigation at Cornell University¹ on whether it pays or not, under farm conditions, to go to the extra labor and risk of docking and castrating male lambs indicated the following conclusions:

1. Wether lambs did not gain faster than ram lambs.
2. Differences in the carcass early in the season are very slight. As the lamb becomes older the wether carcasses are more desirable.
3. Wethers have a higher percentage of rack and loin and a more plump leg than rams. Rams have a higher percentage of head, shoulder, breast, and leg than wethers. The market grade on the wethers was higher.
4. A buyer could afford to pay over 5 per cent more for live weight from wethers than from rams in this test in which the rams were 96 pounds when slaughtered and the wethers (same age) 88 pounds.
5. In the flocks observed one ram died as the result of injuries received while fighting.

A trial at Maryland Agricultural Experiment Station² showed no significant advantage from castration as far as the rate of gain and the quality and the palatability of meat are concerned. The advantage in carcass grade, the great plumpness, and the higher dressing yield of wethers over rams, especially at ages of 20 to 52 weeks, would seem to indicate the desirability of castration as a regular flock management practice.

¹ R. B. Hinman, *The Results of Five Years' Work on Castrating Market Lambs*. American Society of Animal Production, 1931.

² Wells E. Hunt, DeVoe Meade, and B. E. Carmichael, "Effect of Castration of Lambs on their Development and Quality of Meat," *Bull.* 417, Maryland Agr. Exp. Sta., June 1938.

SHEEP PRICES

Although the value of the by-products from the slaughter of sheep is relatively high, lamb or mutton are the main source of income from sheep. Mutton and lamb are highly perishable and as a consequence must move into consumptive channels soon after slaughter. Prices of competitive meats, industrial activity, and the price level are also factors in sheep prices.

Sheep Prices and Sheep Numbers

The prices of sheep are related to sheep production. This cyclical movement in sheep numbers is due to the sheepman's response to sheep prices. When sheep and lamb prices are relatively high, sheep raising is expanded by increasing the size of flocks and establishing new flocks. The production of lamb and mutton increases, and finally prices must be reduced to move the supply of meat into consumption. This process continues to the point where production becomes unprofitable and retraction of sheep raising begins. When production has been reduced, the level of prices begins to rise and expansion occurs. Usually these cycles are completed in seven to ten years. Three to five years of increasing production are followed by a period of the same length of decreasing production.

A comparison of the price of lambs at Chicago and the inspected slaughter of sheep and lambs will illustrate the relation between receipts and prices, which is both seasonal and year to year. Demand for lamb, mutton, and wool is affected by consumer incomes; when the demand is good and supplies not excessive, prices are fairly high.

Seasonal Variation in Sheep and Lamb Prices

In a study of the seasonal variation of sheep prices, it should be recalled that, as most lambs are dropped in the spring, there is a difference in lambs marketed at various seasons. In the late spring and early summer spring lambs predominate, while grass lambs are marketed in the fall and feeder lambs in the fall and early winter.

Lamb prices usually are highest in June, and producers of native lambs try to have their lambs ready for that market.

Prices decline during the summer and fall and then rise in January. This is shown in the tabulation of sheep and lamb prices by months. These averages also illustrate the seasonal change in sheep prices. Low prices prevail in the spring while prices are higher for sheep in the winter and early spring.

The spring drop in prices of lambs and sheep is due to shearing, as the wool is worth more than lamb or mutton. Also it is customary to change the market terms about June 1, and lambs of the previous year, or the old-crop lambs, are classed as yearlings.

SHEEP AND LAMB PRICES
Average Price per 100 Pounds at Chicago,
1930-1939

<i>Month</i>	<i>Sheep</i>	<i>Lambs</i>
January	\$4.15	\$8.94
February	4.33	8.64
March	4.74	8.83
April	4.68	9.02
May	3.52	8.49
June	2.59	9.34
July	2.75	8.61
August	2.83	8.27
September	2.77	8.13
October	2.79	7.79
November	3.11	7.96
December	3.36	8.08
Average	3.47	8.51

It will be noted that the prices of sheep and lambs do not move in the same fashion. June is the high month in lamb prices. Lambs are at their best in that month and are unshorn, and also the supply is relatively short in comparison with the demand. The change in lamb receipts to the shorn basis and then to the new-crop basis causes the marked change in the price of good and choice grades resulting in a May drop and a June high. In the same month (June) ewes are at the lowest price because they have been shorn, and thin ewes predominate as they have not recovered their flesh lost from suckling lambs.

Cash Income from Lambs, Sheep, and Wool

Of the income from the sheep raising enterprise the greatest proportion comes from the sale of lambs. The sale of wool constitutes a larger source of cash income than the sale of old sheep. This is shown in Figure 210.

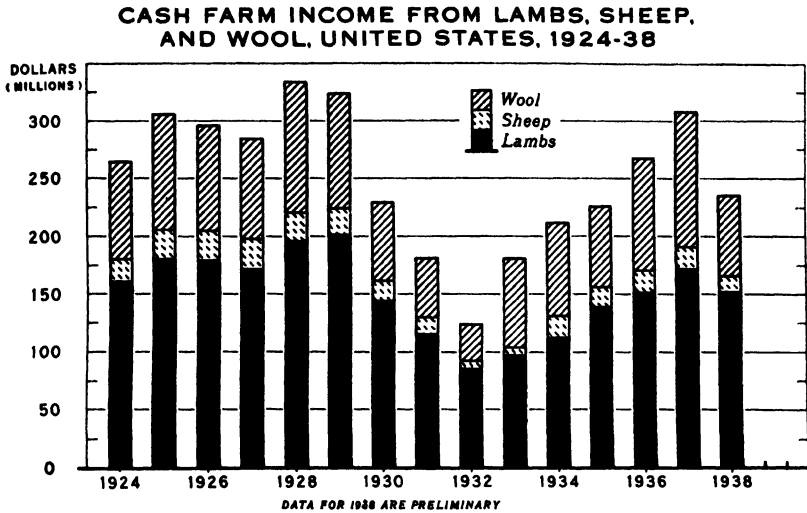


FIG. 210. Cash income from sheep is mostly from the sale of lambs, which, plus the income from sheep sales, will make up 60 to 70 per cent of the total income. (U.S.D.A., Bur. of Agri. Economics.)

Chapter 33

SHEEP SLAUGHTER, MUTTON AND LAMB, BY-PRODUCTS FROM SHEEP SLAUGHTER

SHEEP SLAUGHTER

Sheep slaughter is somewhat more restricted than the slaughter of other farm animals. Actually these establishments operating under federal inspection which slaughter sheep and lambs are less numerous than those slaughtering cattle, calves, or hogs. The average number of head slaughtered per plant is lower with sheep and lambs than with cattle or hogs. The farm or home slaughter, and also retail slaughter, is less in sheep than other slaughter animals. In a recent four-year period 79.5 per cent of the sheep and lamb slaughter was under federal inspection. Other wholesale slaughter accounted for 11.5 per cent, retail 5.5 per cent, and home slaughter but 3.5 per cent. The four national packing concerns (Swift, Armour, Wilson, Cudahy) handle a larger proportion of the slaughter of sheep and lambs than of the slaughter of other kinds of livestock. In a recent five-year period these large national packers slaughtered 74 per cent of the sheep and lambs, 59 per cent of the calves, 54 per cent of the cattle, and 47 per cent of the hogs. Home slaughter of sheep and lambs is low because sheep slaughter is somewhat more difficult than that of cattle and hogs, also the consumption per person is less.

Practically all mutton and lamb is consumed fresh, and rapid movement of the meat to the consumers is highly desirable. Aging the carcass is not practiced, and curing is comparatively rare. Mutton did not become a factor in the meat trade until artificial refrigeration was established. Lamb has become generally available to consumers in the last 40 years, with improved mutton type breeding in sheep and the development of efficient meat distribution.

Centers of Sheep Slaughter

Many of the public or central markets are places of heavy slaughter of sheep and lambs. In some markets of the west a larger proportion of the receipts are reshipped, either for feeding or to other points for slaughter. Denver, for example, is about the largest sheep market, receipts considered, while it ranks ninth in numbers of sheep slaughtered in a recent ten-year period.

Following is a list of the centers of sheep slaughter.

LARGE CENTRAL MARKETS FOR SHEEP SLAUGHTER

Average Yearly Receipts for the Ten-Year Period,
1930-1939¹

<i>Market</i>	<i>Average Yearly Slaughter, Thousand Head</i>
Chicago	2545
Jersey City	1654
Omaha	1456
Kansas City, Missouri	1202
St. Joseph	888
South St. Paul	671
Fort Worth	570
Sioux City	560
Denver	556
East St. Louis	530

Distribution of Sheep Slaughter by Months

Although there is a very uneven marketing of sheep through the year, the outlet for feeders leaves a fairly uniform supply for slaughter. February, a short month, has the lowest total receipts, yet its receipts are over 7 per cent of the year's total. October, the month of heavy receipts, has less than 10 per cent of the entire year's slaughter.

Proportion of Sheep and Lambs Slaughtered

The proportion of lambs in the sheep slaughter has been increasing. In fact, as late as 1890 the *Chicago Daily Drovers Journal* gave no quotations of fat lambs on the Chicago market. Market reports do not generally segregate sheep and lambs, rather sheep are classified into (1) lambs and yearlings and

¹ Data from Agricultural Marketing Service, U.S.D.A. Source: *The Drovers' Journal Yearbook of Figures*.

(2) sheep. This separation was made in the reports of slaughters as early as 1923, at which time lambs and yearlings made up 87 per cent of the slaughter. In 1932 it was 96 per cent, and in 1939, 94 per cent. The increase in the percentage of lambs and yearlings is largely due to the increase in lamb slaughter.

The proportion is caused to vary by the favorableness of the current market and the market outlook. Definitely the market demand has been for lamb rather than mutton. The slaughter

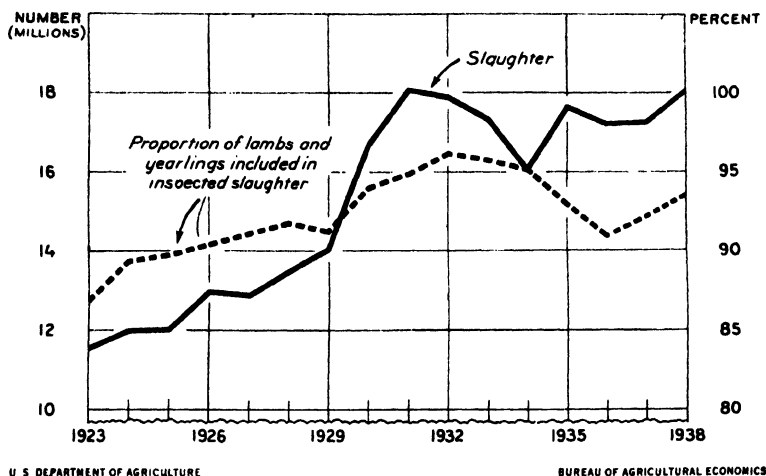


FIG. 211. The proportion of lambs and yearling sheep slaughtered has increased because of the preference for lamb. Total sheep slaughter has also increased. The slaughter is plotted in number slaughtered under federal inspection, while the proportion of lambs and yearlings is in percentages. (U.S.D.A., Bur. of Agri. Economics.)

under federal inspection and the percentage of lamb and yearlings in the slaughter are shown in Figure 211.

The Slaughtering Process

The endless chain method is used in sheep slaughter in the modern packing plant. The sheep are shackled and put on a wheel hoist which delivers them to an overhead rail. Sticking is done as the sheep are hanging by the hind legs. In this step a double-edged knife is inserted into the neck just below the ear so that it severs the large blood vessel in the neck. After bleeding, the first process is that of breaking the fore legs

at the pastern joint just above the foot. A lamb will break a "lamb joint," while in sheep the foot is removed at the round joint. The pelt is then removed, and in this process the fell¹ on the carcass should not be damaged. This is followed by the removal of the hind feet, head, internal organs, the windpipe, and the gullet. The kidney remains in the carcass.

The carcass is opened down the median line and the breast bone is split. The fore legs are folded back at the knee joint and held there by a skewer. A small wooden stick about eight inches long is inserted in the belly to allow for proper chilling and to give shape to the carcass. The carcass is then washed and moved promptly to the cooler. The pelt, which is the skin plus the wool, is sent to the wool pullery, if it has sufficient wool, or to the tannery, if it has short wool.

The pluck consists of the heart, lungs, liver, and the trachea or windpipe.

The carcasses are hung on a rack, ten to a rack, and taken to the cooler after they have been completely washed, wiped, and weighed. The cooling period is from 24 to 72 hours. Some of the better grades are wrapped in special coverings for marketing.

The Dressing Percentage

One of the largest factors in the dressing percentage of sheep is the weight of the pelt. Since wool is worth more than the carcass per pound, the wool yield may be an important item in the slaughter return, and dressing percentage lowered by heavier wool yields would increase the total return. A heavy paunch, or light fleshing, would detract from the value of a slaughter sheep because the carcass is worth more than the by-products other than wool. Certain small parts in the by-product sell for more per pound than the carcass, but the carcass has a higher value on the per pound basis than the offal, other than the wool.

High-dressing sheep are therefore in demand on the market irrespective of the pelt. Mutton type sheep usually have light

¹ Fell is the thin, tough membrane covering the carcass immediately under the pelt. It prevents the meat from drying out on refrigeration or while being roasted. It does not affect the flavor in properly dressed carcasses.

pelts, trim middles, and heavy fleshing, and as a consequence dress high.

The dressing percentage on sheep and lambs will range from 35 to 65 per cent. The average dressing percentage based upon a monthly survey of wholesale slaughters for a ten-year period was 47.10 per cent, with an average live weight of 83.31 pounds and a carcass weight of 39.24 pounds. Sheep dress high following shearing. Also at that time the average live weight is the lowest.

Federal Meat Inspection of Sheep and Lambs

Lamb or mutton which enters interstate or foreign trade is subject to federal inspection, both prior to and after slaughtering. In sheep there are relatively few condemnations by the meat inspection service. In one fiscal year the antemortem inspection resulted in passing 99.92 per cent. In the post-mortem inspection, which included all those inspected on foot except those condemned, 99.79 per cent were passed. Emaciation is one of the largest single causes for condemnation.

MUTTON AND LAMB

Meat from Sheep

Meat has been previously defined. Mutton is meat derived from sheep nearly one year of age or older, while lamb is meat from younger sheep. Immaturity of lambs is rarely encountered in market lambs or as a cause for condemnation on slaughtering.

Mutton is distinguished from other meats by the firm, dense, fine fibers and its dark red color. The fat is hard, firm, brittle, and pure white.

Goat Meat

Some goats are slaughtered for food, but the number slaughtered under federal inspection is quite small.¹ The goat carcass is quite different from the sheep carcass in that it has less fat and longer shanks. The meat is generally paler than sheep meat. The fat is chiefly in the kidney capsules, while there is very little fat on the outside of the carcass or within the muscles.

¹For the fiscal year 1939, 4005 head of goats were slaughtered under inspection of the B.A.I.

In appearance goat carcasses are somewhat like those of the thin wool type sheep, and occasionally goat meat is substituted for mutton or lamb. "Chevon" is the term applied to the meat of the goat. The odor of the meat and fat usually is strong, resembling that of the live goat.

Disposition of the Carcass Lamb and Mutton

For the most part lamb and mutton go to the retailers fresh and as whole carcasses and are distributed much the same as beef. Usually the carcasses are broken down to the retail cuts directly by the retailer. However, some wholesale cuts are recognized and are available on wholesale markets of some size.

A small amount of mutton and lamb is frozen and held for a future market. Also there is a very small quantity cured. Carcasses of the kind that are not acceptable to the trade are processed at the packing plants. This gives an outlet for canner sheep, which are mainly old thin ewes. These are processed and sold as "prepared meats" and "meat food products."

Lamb, Yearling, and Mutton¹

We recognize on the market carcasses of lambs, yearlings, and mutton. The exact age at which these changes take place is a little indefinite. There are certain features which are characteristic of the different groups; these differences are the results of changes which occur at different stages of maturity in the animal. Age produces changes in the character, color, and consistency of the flesh and bones, and, to a lesser extent, in the consistency and character of the fat.

BONES

The hardness and color of the bones are a good indication of the age, in every case. Hardness of bones can be determined by observing the color of the ribs in the chest cavity and the bones in the shank and break joint. Redness in bones indicates a young animal, and whiteness indicates age.

The "break joint" is the most reliable indication of the age. In young lambs, the fore feet are taken off at the break joint or,

¹ From *Food and Nutrition News*, Vol. VII, No. 5, National Livestock and Meat Board.

as it is sometimes called, "the lamb joint." The break joint has four well-defined ridges which are smooth, moist, and red.

As lambs approach the yearling stage, the bones become harder and white. The break joint retains some of the sawtooth effect, but is harder and more porous. Ewes tend to ossify the break joint earlier than wethers.

When the mutton stage is reached, the break joint cannot be made and the fore feet must be taken off at the



FIG. 212. Joints at which the front foot is removed in dressing sheep and lambs. A smooth joint from a mature sheep (left), a crushed break joint from a yearling, and a break joint from a lamb.

round joint, which is just below the true break joint.

COLOR OF FLESH

Another means of distinguishing between lamb and mutton is the color of the lean. In lamb, the color of the flesh varies from light to dark pink. As the animal grows older, the color

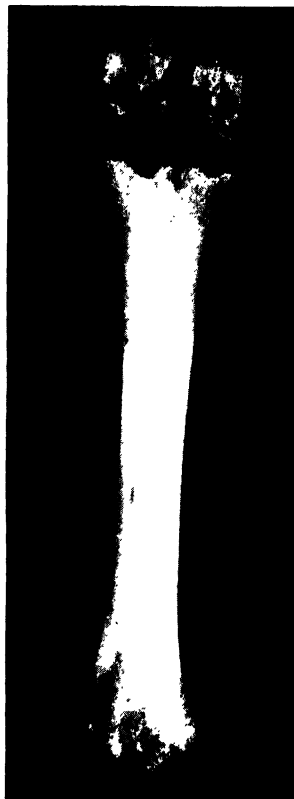


FIG. 213. The bones of the fore leg, from the knee to the pastern joint, of a lamb, showing both the break joint and the smooth joint. The smooth or mutton joint is nearer the foot than the break or lamb joint.

deepens. In yearlings, it will be medium pink to light red; in mutton, the color will range from light to dark red.

FAT

Lamb fat is softer than that of yearling or mutton. It is creamy white or slightly pink in color. The fat in yearlings is whiter and slightly more brittle than lamb fat. Mutton fat is white and possesses still more hardness and brittleness than that found in yearlings.

Market Classes and Grades of Dressed Lamb and Mutton

The carcasses of lambs, yearlings, and mutton are graded largely on the basis of three factors — conformation, finish, and quality. The grade and the classification are much the same as those used for beef. Following are the definitions of these terms and their application to carcasses.¹

CONFORMATION

Conformation is the form, shape, outline, or contour of the carcass. It ranges from the smooth, plump, well-rounded, well-proportioned conformation of the most highly developed carcass produced, to the rough, rugged, irregular, disproportioned conformation of the thinnest, boniest, most poorly shaped carcass produced.

FINISH

Finish is fat, and includes the fat which appears on the outer surface of the carcass, on the inner walls of the chest and abdomen, around the kidneys, the seams of fat which sometimes lie between the larger muscles, and the distribution of fat through the muscle tissues. Finish involves not only the quantity of fat but its quality and distribution. Finish ranges from that of the carcass which is almost completely covered both inside and outside with a smooth layer of firm fat, to that of the carcass totally lacking in discernible fat.

¹ From *Regulatory Announcement No. 123*, U.S D A., March 1931.

QUALITY

Quality is largely a characteristic of the flesh. It includes texture, tenderness, juiciness, flavor, and color. Quality also involves ratios or proportions of flesh to bone and of fat to lean meat. Quality, therefore, ranges from that of the small-boned, heavily fleshed, highly finished, well-proportioned carcass possessing a very high degree of tenderness, juiciness, and flavor, and very fine fiber or texture, to that of the very large-boned, thinly fleshed, ill-proportioned carcass with an extremely low degree of tenderness, juiciness, and flavor, and extreme coarseness in texture.

Following is the schedule used for sheep carcasses:

<i>Carcasses</i>	<i>Grades</i>
Lamb	Prime
Yearling	Choice
Mutton	Good
	Commercial
	Utility
	Cull

Weight of Sheep Carcasses

A weight separation of carcasses is common in market quotations. A market report for one day shows the common weight division, grade, and prices.

FRESH LAMB AND MUTTON — WHOLESALE MARKET QUOTATIONS,
CHICAGO, APRIL 18, 1941

<i>Grade</i>	<i>Weight, Pounds</i>	<i>Price, Dollars</i>
<i>Lamb:</i>		
Choice	30-40	
Choice	40-45	17.00-18.00
Choice	45-50	16.00-17.00
Choice	50-60	15.00-16.00
Good	30-40	16.00-17.00
Good	40-45	16.00-17.00
Good	45-50	15.00-16.00
Good	50-60	14.00-15.00
Commercial	All weights	15.00-16.00
Utility	All weights	14.00-15.00
<i>Mutton (Ewe):</i>		
Good	70 down	10.00-11.00
Commercial	70 down	9.00-10.00
Utility	70 down	8.50- 9.00

It will be noted that both grade and weight are factors in the market price. The heavier carcasses are discounted in price because of the consumer preference for small cuts. Lamb carcasses in the weight range of 35 to 45 are usually quoted at the highest prices, but there may be times when more or less weight is accepted without a price discount. Heavy lamb carcasses up to 60 pounds compete with light yearling and mutton carcasses. In some cases very heavy lamb carcasses are sold as yearlings even though they may show a break joint.

Carcass Grades and Fatness

The higher grade lamb carcasses are those which carry the most finish or fat. Such carcasses may have a lower proportion of lean, but they contain a larger edible portion and a smaller percentage of bone and ligament. The relationship of grade to physical composition is shown in the data tabulated below. This U. S. Department of Agriculture study included the carcasses of 51 lambs.

AVERAGE PHYSICAL COMPOSITION OF LAMB CARCASSES
OF THE DIFFERENT MARKET GRADES

	<i>Grades of Carcass</i>					
	<i>Prime</i>	<i>Choice</i>	<i>Good</i>	<i>Commer- cial or Medium</i>	<i>Utility or Common</i>	<i>Cull</i>
Average chilled, dressed carcass weight, pounds	50.6	43.2	34.5	31.9	21.3	16.6
Dressed carcass as analyzed						
Separable fat, per cent	32.5	29.6	22.5	18.6	16.2	7.1
Separable lean, per cent	50.1	50.4	53.8	58.2	55.1	57.8
Edible portion, per cent	82.6	80.0	76.3	76.8	71.3	64.9
Bone and ligament, per cent	17.4	20.0	23.7	23.2	28.7	35.1

It will be noted then, in the physical separation that as the fatness was increased the carcass weight increased as also did the percentage of edible portion while the percentage of separable lean and bone and ligament decreased. Lamb classed as choice is too fat for wide acceptance in the retail trade.



Numerals in circles refer to wholesale cuts. Other numerals refer to retail cuts

YIELDS OF WHOLESALE CUTS

	<i>Per cent of carcass</i>	<i>Subdivisions</i>	<i>Per cent of carcass</i>
1, 2, and 6, Hind Saddle.....	50.0%	1, Legs.....	33.0%
3, 4, and 5, Fore Saddle.....	50.0%	2 and 6, Loin and flank.....	17.0%
		3, Hotel Rack.....	12.0%
		4, Chuck Inc. Neck.....	23.5%
		5, Breast Inc. Shank.....	14.5%

FIG. 214. Wholesale and retail cuts of lamb and mutton. (U.S.D.A.)

Wholesale Cuts of Lamb and Mutton¹

The major wholesale cuts of lamb and mutton (see Figure 214) generally recognized in all markets are hind saddle and fore saddle, each comprising about 50 per cent of the carcass weight. The division is made between the twelfth and thirteenth ribs, one pair of ribs remaining on the hind saddle. Saddles are subdivided into legs, which represent 33 per cent, and loins, including flank, which comprise 17 per cent of the total weight of the carcass. These cuts are divided as shown in figure. Loins include the flank and kidneys.

Foresaddles are subdivided into hotel racks, which include parts of nine pairs of ribs, or 12 per cent; chucks, including neck, or 23.5 per cent; and breasts, including shanks, or 14.5 per cent of the carcass weight. Slight variations in percentage weights of the various cuts at different markets are not unusual, and there are also slight variations in yields of cuts from different grades. Neither of these, however, is very marked.

Other terms which are fairly common in certain markets are "rattles," "stews," and "slugs." These terms refer to the same cut, which consists of the chucks, breast, neck, and shanks. It comprises all of the fore quarter except the rack. A "wing" consists of the two shoulders, shanks, neck, and



FIG. 215. A choice lamb carcass. Packers' cover and brand on label on the better grades of lamb carcasses. (Armour and Co.)

¹ W. S. Davis, "Commercial Cuts of Meat," *Circ. 300, U.S.D.A.*, April 1940.

breasts. A "bracelet" comprises the rack plus the portions of the breast which correspond with the plates in a beef carcass.



FIG. 216. Loin chops of lamb, the highest priced common cut of lamb. (National Livestock and Meat Board.)

Prices of Mutton and Lamb Carcasses

Mutton is lower priced than lamb. On the wholesale market in New York the average price for good grade lamb carcasses



FIG. 217. Lamb chops prepared for the table. (National Livestock and Meat Board.)

was \$16.92 for the period of 1930-1939. During that same period mutton carcasses (ewes) of good grade were \$9.18, a little more than half as much as lamb.

Prices of Different Lamb Cuts

Low prices for some lamb cuts are necessary in order to sell the entire carcass. The most desirable cuts are priced high to balance up with the cuts that must be priced low to move them. Following is a tabulation of the prices of several retail lamb cuts at New York based on a ten-year average 1930-1939.

<i>Retail Cut of Lamb</i>	<i>Retail Price, Cents per Pound</i>
Loin chops	41.27
Rib chops	33.79
Leg of lamb	26.37
Lamb chuck	19.95
Shank and neck	12.16
Breast	11.23

Lamb and Mutton Consumption

Our imports and exports of lamb and mutton have been negligible, and as a consequence the production is practically

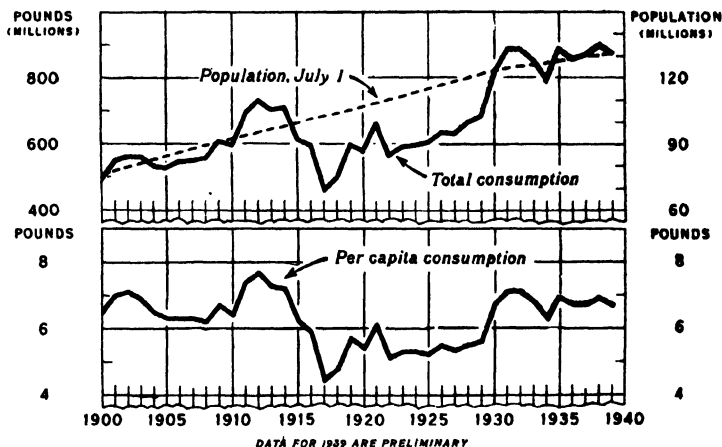


FIG. 218. Mutton and lamb consumption, total and per capita. The total production and consumption have increased. Per capita consumption has fluctuated markedly from year to year. (U.S.D.A., Bur. of Agri. Economics.)

the same as the amount consumed. Cycles in consumption occur which are the same as the cycles of production, as it is domestically consumed and there is but little storage of lamb and mutton.

Per capita consumption of lamb and mutton was quite low from 1917 to 1929. Since 1929 consumption has been at about the same level as the 1900–1915 period. From 1899–1939 inclusive the yearly per capita consumption has ranged from a high of 7.7 pounds in 1912 to a low of 4.5 pounds in 1917, with an average of 6.28 pounds for the period. (See Figure 218.)

Lamb consumption is the heaviest in the middle Atlantic, New England, and Pacific states, where the per capita consumption is over 12 pounds per year. About 70 per cent of our lamb production is consumed in those sections.

The mutton and lamb consumption is quite high in Australia and New Zealand where it may range from 50 to 100 pounds per person annually. In the United Kingdom and Argentina the consumption is over 20 pounds per capita yearly.

BY-PRODUCTS FROM SHEEP SLAUGHTER

The value of the by-products from sheep slaughter is higher proportionately than that from other slaughter animals. This is due to the value of the pelt which accounts for about 14.5 per



FIG. 219. Applying depilatory to the flesh side of a pelt preparatory to "pulling" the wool. (Armour and Co.)

cent of the slaughter income. The by-products other than the pelt commonly return an income about comparable to that of cattle, exclusive of the hide, and somewhat less than calves and more than hogs. Stated in another manner, the by-product return from slaughter exclusive of the hide or pelt, is most for calves and least for hogs, while sheep and cattle are intermediate. For sheep the income from the by-products other than the pelt is about 4.1 per cent of the slaughter income. The entire by-product return equals 18.6 per cent; therefore, 81.4 per cent of the slaughter income is from the carcass meat. Income from meat and by-products changes from time to time. In the early days of the packing industry the by-products were a liability rather than an asset. This has happened in recent times with some by-products when prices were low.

Yield of Various Products

In the following tabulation the main products and the quantity yielded from the slaughter of sheep are given. This is based upon approximate yields for an average lamb.

WEIGHT (BY PERCENTAGE) OF VARIOUS LAMB PRODUCTS¹

<i>Summary</i>	<i>Pounds of Product in Average Lamb</i>	<i>Per Cent of Finished Product to Live Lamb</i>
Dressed lamb (carcass)	39.5	47.0
Edible by-products		
Tongue, liver, heart, sweetbreads, brains	1.7	2.0
Oleo oil and stearine	2.0	2.4
Inedible by-products		
Pelt { Wool	4.0	4.7
Skin	5.5	6.6
Fats: rendered tallow, oil, and grease	.6	.7
Soft bones	.5	.6
Trotters	1.3	1.5
Blood (dried)	.7	.8
Casings (finished)	.5	.6
Tankage	2.4	2.8
Valueless material and shrinkage	25.3	30.3
Total	84.0	100.0

In the case given the 84-pound lamb dressed 47 per cent and yielded a 39.5-pound carcass. About 30 per cent of the live

¹ Swift and Co., *Agriculture Research Bull.* 10, November 1937.

lamb is valueless material and shrinkage. The latter is mainly moisture loss, and the valueless material is such as paunch contents which is practically worthless.



FIG. 220. Pulling wool. As the wool is pulled it is sorted in different grades. (Armour & Co.)

Disposition of Sheep By-Products by a Large Packing Company

The principal by-products of sheep slaughter, those finished by the packing company and those manufactured after leaving the packing company, are listed by Swift and Co.¹ as follows.

<i>Principal By-Products Obtained from a Lamb</i>		<i>Finished By-Products Prepared by Swift & Company</i>	<i>By-Products Manufactured after Leaving Swift & Company</i>
Head	Brains	To Retailers	
	Tongue	To Retailers	
	Cheek and Head	Sausage	
		To Retailers, Sausage	
	Bones {Jaws }	Glue	
	Inedible Fats	Steam Bone	
		Glycerine	
		Soap	{Cosmetics Polish Base Soap

¹ *Ibid.*

<i>Principal By-Products Obtained from a Lamb</i>		<i>Finished By-Products Prepared by Swift & Company</i>	<i>By-Products Manufactured after Leaving Swift & Company</i>
Pelt	Pulled Wool	Clean Fleece	Bed Blankets, Surgical Dressings, Automobile and Furniture Upholstery, Felts, Baseball Yarn, Draperies, Tennis Ball Covers, Hosiery, Flannels, Dress Goods, Knitting Yarns
		Lanolin	Cosmetics, Belt Dressing
	Slat (Skin After Wool or Fleece is Removed)		Glove Leather, Coat Leather, Chamois Leather, Shoe Leather Linings for Shoes Ladies Shoes Hat Sweat Bands College Diplomas Novelties
	Trimming	Glue Tankage	
	Tanned Short Wool Pelt		Sheepskin Coats, Robes, Rugs, Felts, Slippers Shoe Polishers
Trotters (Feet)	If Cooked for Glue	Glue Liquor—Glue Tallow—Soap Glue Bone Tankage Fertilizer Bone Meal	Soap Fertilizer
	If Steam Rendered	Tallow—Soap Digester Tankage Bone Tankage Fertilizer Tankage Tallow—Soap Bone Cracklings	Soap Fertilizer Soap Animal Feed
	If Dry Rendered	Meat and Bone Scraps—Animal Feed	
		Mutton Tallow	Leather Dressing Pharmaceutical Uses
Fats	Edible	Stearine—Oleo Oil Mutton Tallow—Soap	
	Inedible	Glycerine	Anti-Freeze, Paints, Cellophane, Liquid Soap, Medicinal Preparations Cosmetics, Polish Base, Soap Albumin-Weatherproof Glue Serum, Pharmaceutical Uses (Medicines)
Blood		Fresh—Sausage	
		Dried { Blood Flour Blood Meal Animal Feed	Plaster Retardant
Casings		Sausage Containers	Strings of Musical Instruments Tennis Racket Strings Surgical Ligatures (Catgut) Pharmaceutical Uses

<i>Principal By-Products Obtained from a Lamb</i>		<i>Finished By-Products Prepared by Swift & Company</i>	<i>By-Products Manufactured after Leaving Swift & Company</i>
Fancy Meats	Heart	{ To Retailers, Sausage	Animal Feed
	Liver	{ To Retailers, Sausage	Animal Feed
	Sweetbreads (Neck and Heart)	To Retailers	
	Kidneys	{ To Retailers, Sausage	
	Stomach		Animal Feed
	Pluck		
	Lung	To Retailers	
	Liver	To Retailers	
	Heart	To Retailers	
	Melt		Animal Feed
Glands	Fries	To Retailers	
	Pituitary	{	Pharmaceutical Uses (Medicine)
	Thyroid		
	Ovaries		
	Pancreas		
	Suprarenals		

Pulled Wool

Following slaughtering the pelt is sent to the wool house or "pullery." If the packing plant does not have such facilities available, the pelts are treated with salt and so preserved for storage until the accumulation is delivered to the "pullery." Pelts with short wool — less than three-quarters of an inch — are sold in pelt form rather than separated into the pulled wool and skin.

A lamb pelt suitable for pulling will yield about 4 pounds of pulled wool and have a skin with a weight of 5.5 pounds. The season of slaughter is a big factor in pulled wool yields. Pulled wool yields are lower than shorn yields because the pelts are washed before the wool is pulled, wringing to remove excess water following washing. A depilatory solution made of sodium sulphide, slaked lime, and water is applied to the skin side of the pelt and after hanging on a rack for a time the wool is removed by hand pulling. As the wool is pulled it is put into containers by grades.

The amount, quality, and condition of the fleece, therefore, affect the value of the pelt, as do the length, shrink, and color of the wool. The value of the skin is also a factor in the return from the pelt.

Sheep Skins

After the wool is pulled, the skin or "slat" is washed and soaked in salt pickle solution which contains salt and some sulphuric acid. After this treatment, the pelts are graded for quality and size. Leather from sheep skins varies a great deal. That from the long wool breeds is quite durable, while leather from Merino pelts is thin and generally poor in quality. This skin is then manufactured into leather and is used for coats, jackets, gloves, cheap shoes, slippers, linings for shoes, ladies' shoes, hat sweatbands, chamois skin, diplomas, and many other items.

Sheep skins with short wool are tanned with the wool on and used for coats, robes, rugs, felts, slippers, and other articles.

Sheep Fats

Most of the fat from the sheep is left with the carcass. Sheep fat has a high melting point owing to a large proportion of highly saturated fatty acids in the fat. The caul and ruffle fat are used as edible fats. The inedible fats and greases are used in soaps, glycerin, and other commercial products.

Other By-Products of Sheep Slaughter

A wide range of pharmaceutical or medicinal substances is recovered in the dressing of sheep. The glands of the pituitary, thyroid, ovary, pancreas, suprarenals, and others are the source of such materials. For example, suprarenalin, which is obtained from the adrenal gland just above the kidneys, is a powerful astringent and heart stimulant. The glands from 135,000 sheep are necessary to yield one pound of the extract. Glue, tankage, bone meal, fertilizer, fancy meat casings, ligatures, and a host of other useful materials result as by-products in sheep slaughter.

Chapter 34

WOOL

Wool is the most important of the animal fibers. The fleece may return from 20 to 40 per cent of the total income from the farm flock and even a greater proportion with a range or ranch flock. Apparently sheep were among the first of the animals domesticated, as the arts of weaving and felting are among the first recorded.

Classes of Textile Fibers

Roughly there are three classes of fibers.

ANIMAL FIBERS

These include wool, mohair, alpaca, vicuna, cashmere, camels' hair, horse hair, and cattle hair. Silk is likewise an animal product.

VEGETABLE FIBERS

This group includes cotton, flax, hemp, jute, and many other fibers and grasses of less importance.

ARTIFICIAL FIBERS

These also make up a sizable percentage of textile materials. They include such fibers as rayon or artificial silk and similar fibers.

There are four important textile materials, cotton, wool, rayon, and silk. The annual per capita consumption of cotton is about 25 pounds, but there are wide fluctuations in the amount used. The annual consumption of wool, exclusive of carpet wool, is about 4 pounds per person. There has been a slight decrease in its consumption the past two decades. The use of rayon yarn and raw silk, on the other hand, has increased. The annual consumption per person is slightly more than a pound

for rayon, and somewhat less, about 0.8 pound, for silk. Consumer habits are continually changing, and improved manufactured textiles have caused changes in the materials consumed. Wool for clothing is in less demand than formerly because of our more sheltered living.

Wool Production

WORLD WOOL PRODUCTION

The largest proportion of the world wool supply is raised in the southern hemisphere. (See Figure 221.) A considerable

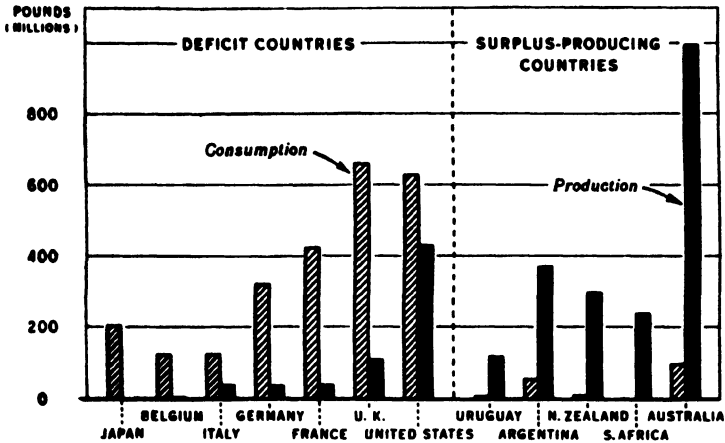


FIG. 221. Surplus wool producing countries are in the southern hemisphere, while the deficit countries are in the northern hemisphere. Australia has the largest surplus, and the United Kingdom has the greatest deficit. (U.S.D.A., Bur. of Agri. Economics.)

part of this production enters into the world trade, as the wool deficient countries are in the northern hemisphere. For a five-year period the annual world wool clip has averaged 3650 million pounds. The production in the United States is about 12 per cent of the world production.

Wool is a large item in international trade. Following is a list of countries with surplus stocks, which consequently are exporting countries.

PRINCIPAL EXPORTING COUNTRIES

	<i>Average Export, 1930-1934, Thousand Pounds</i>
Australia	831,595
Argentina	298,497
Union of South Africa	277,504
New Zealand	237,843
Uruguay	114,502
British India	38,276
China	28,737
Chile	23,536
Iran	12,238
Ireland	11,906

The countries which produce an insufficient amount of wool for their own needs and are therefore heavy wool importing countries are listed below.

PRINCIPAL IMPORTING COUNTRIES

	<i>Average Imports, 1930-1934, Thousand Pounds</i>
France	588,871
United Kingdom	576,571
Germany	335,535
Japan	186,681
Belgium	164,322
Italy	144,051
United States	133,397
Russia	62,649
Czechoslovakia	35,852
Poland	33,591

WOOL PRODUCTION IN THE UNITED STATES

The yearly production in this country for a ten-year period was 366,488,000 pounds of shorn wool and 64,720,000 pounds of pulled wool. During the same period we imported 64,703,000 pounds of apparel wool. Therefore, there was annually about 496,911,000 pounds of apparel wool available for consumption. We produce but little carpet wool, which is wool too coarse to be classed as apparel wool. Of the total wool we use, about 29 per cent is imported.

LEADING WOOL PRODUCING STATES

Most of the wool raised in this country is grown in the range states. Following is a list of the states ranking high in total amount of wool grown for a recent three-year period.

<i>State</i>	<i>Wool Grown, Thousand Pounds</i>
Texas	77,477
Wyoming	31,561
California	27,777
Montana	25,674
Utah	19,525
Ohio	18,089
Idaho	17,632
Oregon	17,300
New Mexico	15,321
Colorado	13,116
Iowa	9,725
South Dakota	9,096
Missouri	8,898
Michigan	8,440
Minnesota	7,902

The yield of wool per sheep per year is high in the range states. For 1939, the average annual yield per sheep in this country was 7.96 pounds. The western states averaged 8.4 pounds per sheep, and Wyoming topped all states with a 9.7-pound average yield. The annual yield of wool per sheep for the south Atlantic states was 5.1 pounds, and Florida was low with a 3.0-pound average. The difference in fleece yield is due to breeds, nutrition, extraneous material, and other conditions.

Wool Characteristics and Market Grading

WOOL AND HAIR COMPARED

Wool is a modified hair structure. The slight differences from typical hair are responsible for the economic value of wool. Wool is elastic and has a scaly exterior. Hair is less elastic and quite smooth. These differences give wool fiber its "felting" qualities, as the serrated fibers cling together. This peculiar property, together with the elasticity, makes it possible to spin a strand of yarn as the fibers interlock in the sawlike edges of their scales. Wool also differs from hair in appearance, as the wool fibers are crimped while hair is always straight or curled.

WOOL SHRINKAGE

The fleece as it is shorn from the sheep is known as "grease wool," "greasy wool," or "wool in the grease." The foreign

material in the fleece, the "shrinkage," is removed by scouring the greasy wool in a soap and soda solution. The clean scoured wool is termed "yield of clean content" of the fleece. The wool



FIG. 222. Typical wool fiber magnified 160 diameters. (From *Structure of the Wool Fiber*, by F. H. Bowman.)

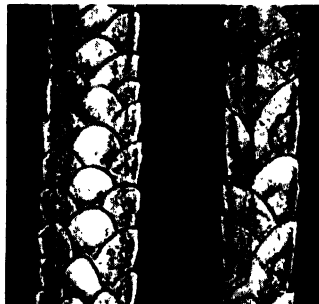


FIG. 223. Human hair magnified 120 diameters. (From *Structure of the Wool Fiber*, by F. H. Bowman.)

impurities which constitute the shrink have been grouped by Burns ¹ as follows.

WOOL IMPURITIES

1. Indigenous

- A. Accretions, such as kemps, gray fibers, and gray hair.
- B. Excretions, such as dung, manure dust, and urine.
- C. Secretions, such as yolk or grease, and sweat or suint.

2. Extraneous

- A. Of animal origin, such as ticks and bugs.
- B. Of vegetable origin, such as burrs, straw, sagebrush, grease-wood, and cactus.
- C. Of mineral origin, such as sand and dirt.
- D. As applied by man, such as paint, tar, and dips.

Moisture is also present in the fleece, the amount being dependent upon moisture in the air. Prior to shearing, sheep are often held in an enclosed place to cause them to sweat, which moistens the fibers and softens the yolk and facilitates shearing. Shearing in rainy weather or making the sheep sweat too heavily should be avoided as it will cause the moisture content to be high. The moisture content of wool will normally range from 12 to 17 per cent and may be as high as 30 per cent.

¹ Robert H. Burns, *Bull.* 225, Wyoming Agr. Exp. Sta., February 1938.



FIG. 224. Shearing by machine. Most sheep are shorn by machine rather than by hand clippers. (Chicago Flexible Shaft Co.)



FIG. 225. Sheep shearing in competition. Note the various stages in the removal of the fleece shown by the different contestants. (Chicago Flexible Shaft Co.)

AMOUNT OF SHRINKAGE IN WOOL

The amount of shrinkage is not a factor in the grading of wool but it is an important factor in determining the value of a fleece. However, in wool grading shrinkage may be considered and wool of a grade is divided further on the basis of its shrink. That is, we may have fine staple wool with (1) heavy shrink, (2) medium shrink, (3) light shrink. Many quotations



FIG. 226. A fleece tied up with paper twine. Wool as it comes from the sheep is known as "grease wool" or "greasy wool." (Agricultural Marketing Service, U.S.D.A.)

of wool prices are on the basis of clean or scoured wool. If, for example, wool is quoted at 35 cents each pound as grease wool, and if the loss in weight as a result of the removal of foreign matter is 50 per cent, the wool would be worth 70 cents per pound on the scoured basis excluding the cost of scouring.

The shrink in wool may range from 30 to 80 per cent. Fine wool shrinks more heavily than coarse wool. Buck fleeces will shrink from 2 to 4 per cent more than ewe fleeces of the same type.

The refined wool fat is lanolin, which has various commercial uses, for example, as a base of salves and ointments.

VARIATION IN SCoured WOOL

There is much real variation with breeds as to the physical characteristics of wool. In fact, no two fleeces are identical, and even within a single fleece there may be much variation in the wool. The wool on the hips is coarser, for example, than the wool on the shoulder. Even within a sample, fiber size varies. Apparently there is no relation of clipping to wool growth, that is, frequent shearing does not increase wool growth rate and lack of shearing even annually does not affect the rate.

Scouring is the washing of the grease wool with soap, hot water, and a little alkali, usually sodium carbonate. Scouring is generally done by the emulsion process, in which the wool fat combines with the wash water, rather than being dissolved out as in the solvent process.



WOOL GRADING

The grade of the wool is determined mainly by the diameter or fineness of the fiber. Other factors which affect the value, such as the condition of the fleece, length of the staple, and strength and character of the fibers, are considered in grading, but fiber thickness is the dominant qualification. Grading is a term that is used for the separation process which involves finally both classes and grades.

The purpose of grading is to make available to the trade wool of fairly uniform characteristics. The grading is done by experienced graders who can identify grade by appearance and

FIG. 227. The wool grader at work. A lock is examined to determine the fineness and strength of the staple. (Ohio Wool Growers Co-operative Association.)

touch. In the process of grading the grader examines each fleece individually, noting the fineness of the fiber. He removes a lock of wool from the fleece by holding the tip or outside end of the lock. The length is measured by pulling the lock back along the thumb. This is called "stapling," and the length is referred to as staple. A combing wool will extend down to the



FIG. 228. Wool being graded. The wool is open and each fleece is graded separately by an experienced grader. (The Ohio Wool Growers Association.)

second joint of the thumb, about $2\frac{1}{2}$ inches. After an examination of two or three representative locks, the grader throws the fleece into a pile or bin for the class and grade.

Wool is seldom graded on the farm. This function is performed by an agency, dealer, or cooperative organization which usually has facilities for storing. Wool processors make their purchases from such agencies because they buy by grade and because their purchases are not as seasonal as the movement of wool.

GRADING OF WOOL A NECESSITY

Manufacturers of woolen goods require specific grades. Most manufacturers produce only a few kinds of yarns or fabrics, and as a consequence, the grades which one mill may use are very few. In fact, in mills the individual fleeces are divided up into parts (which is called "sorting") to form groups of more uniform characteristics. Wool textile mills are very highly specialized and are generally limited in the fabrics they make, so they purchase graded wools.

The various qualities that affect the value of wool to a manufacturer are fineness, length, strength, elasticity, crimp, softness, pliability, uniformity, color, luster; also felting, spinning, and working properties. The manufacturer uses the term "character," which refers to the spinning quality of wool when scoured. Wool that is soft and springy to the touch, even in crimp, good in color, and not frouzy or wasty is considered to have good character.



FIG. 229. Wool in storage at a warehouse of a wool growers co-operative association. After grading the wool is stored by grade until it is sold. (The Ohio Wool Growers Association.)

WOOL GRADES

There are two systems of wool grades: (1) the English or spinning count system, and (2) the United States system. In this country we are changing from the latter to the former system of grade nomenclature. The official U. S. Standard Wool Grades adopted in 1926 are based on the count system. The English or spinning count system is based on the number of hanks of yarn that can be made from 1 pound of scoured, combed wool or top. The finer the wool fiber the greater the length of yarn from a given weight. A hank is 560 yards. A grade of 50's would therefore indicate that 50 hanks could be

made from 1 pound. However, in practice less than 50 hanks is usually made from such wool. A 60's wool would be finer than a 50's wool.

The American system is based on certain grade terms which developed with our wool trade. This grading system is commonly called the "blood system." It was supposed to have originated when the Merino wool was termed "fine" and other wools were graded on diameter of fiber based on fineness compared to Merino wool. Supposedly the term indicated proportions of Merino blood or breeding. So the grades were (1) fine, (2) half blood, (3) three-eighths blood, (4) quarter blood, (5) low quarter blood, (6) common, and (7) braid.

Following is a list of the grades of both English and American systems in comparable order. For example, 56's is the same as three-eighths blood.

<i>English</i>	<i>American</i>
80's, 70's, 64's	Fine
60's, 58's	Half blood
56's	Three-eighths blood
50's, 48's	Quarter blood
46's	Low quarter blood
44's	Common
40's, 36's	Braid

Most of the wool produced in this country is of the first four grades. For a ten-year period 96.5 per cent of our shorn wool was quarter blood or finer, 2 per cent was low quarter blood, 1 per cent common, and 0.5 per cent braid.

SIZE OF WOOL FIBERS

In a fleece which is graded as a 40 there will be a range in the diameter of the wool fiber from 10 to 70 microns.¹ Even with a Merino fleece a range in the diameter of the fibers from 10 to 30 microns is common. In medium wool on the fine side the average diameter of the wool fiber will be about 24 microns, while a fleece of medium wool on the coarse side will have fibers that average 32 microns in diameter. The fine fibers are on the shoulders, while the coarse fibers are on the thighs.

¹ A micron equals 1/1000 millimeter, or 1/2500 inch.

OFFICIAL STANDARD GRADES

The first established system of grades by the U. S. Department of Agriculture, set up in 1923, was based upon the United States grades. In 1926 new standards were devised based upon the British system of spinning counts to designate fineness. Both systems are in use optionally in the trade except that in United States licensed warehouses the newer standard is used.



FIG. 230. Typical wool fibers of different grades: A, fine wool; B, quarter blood wool; C, braid wool (magnified). (Agricultural Marketing Service, U.S.D.A.)

Samples of wool representing the official grades mounted upon cardboard may be secured from the Bureau of Agricultural Economics of the U. S. Department of Agriculture. (See Figure 231.)

CLASSIFICATION OF WOOL BY LENGTH

Sheep, it will be recalled, were grouped into the classes fine wool, medium wool, and long wool on the basis of the character of the wool. Wool staples will range in length from $\frac{1}{2}$ inch up

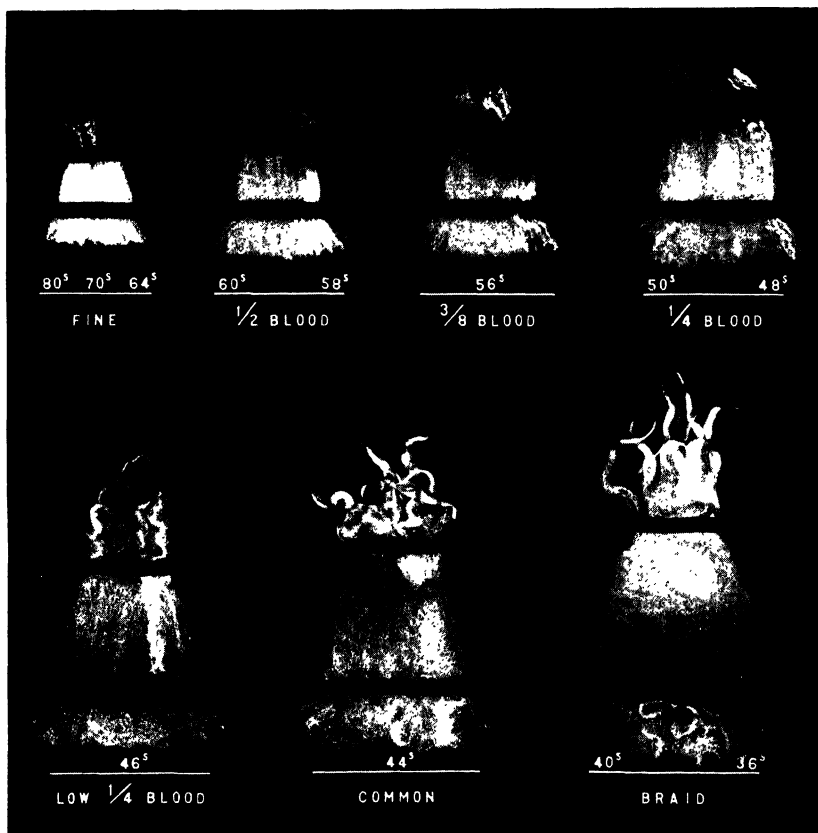


FIG. 231. Grades of wool representative of the official standards of grades of wool and the corresponding numerical terms. (Agricultural Marketing Service, U.S.D.A.)

to 12 to 15 inches. As length of wool is one of the characteristics which affects the value of the wool to the manufacturer, wool graders also classify wool on length. Following is a tentative classification of wool for length of staple in inches.

The grades common and braid are not divided according to length of staple, as they are usually of strictly combing length.

CLASSIFICATION OF WOOL BY LENGTH

<i>Grade</i>	<i>Strictly Combing</i>	<i>French Combing</i>	<i>Baby Combing</i>	<i>Clothing</i>
Fine	Over 2	1 $\frac{1}{4}$ -2	....	Under 1 $\frac{1}{4}$
Half blood	Over 2 $\frac{1}{4}$	1 $\frac{1}{4}$ -2 $\frac{1}{4}$	....	" "
Three-eighths blood	Over 2 $\frac{1}{2}$	....	1 $\frac{1}{2}$ -2 $\frac{1}{2}$	Under 1 $\frac{1}{2}$
Quarter blood	Over 2 $\frac{3}{4}$	....	1 $\frac{1}{2}$ -2 $\frac{3}{4}$	" "
Low quarter blood	Over 3	....	2-3	Under 2

CLASSIFICATION OF WOOL BY REGIONS¹

In market practice the trade freely identifies wool with the states or region in which it was grown because the character and appearance of the wool often are affected by conditions in those areas. At least four major regions of the United States so affect the character of the wools grown therein as to distinguish them from wools grown in other regions. Grease wools grown in these different regions differ in condition, shrinkage properties, and color because of differences in soil, in grazing and climatic conditions, and in husbandry practices.

These variations often affect materially the market value of the grease wools, even of the same grade. In recognition of this fact, the wool trade has broadly classified domestic wools into four general groups based on areas of production, as follows: Territory wool, semibright wool, bright wool, and southern wool.

TERRITORY WOOL. That part of the domestic clip produced west of the one hundredth meridian is known in the trade as "territory wool." It comes from the states of Washington, Montana, Idaho, Wyoming, Nevada, Utah, and Colorado, the western halves of North Dakota and South Dakota, and occasionally from western Kansas and Nebraska.

Sheep in the "territory" states graze over wide areas, are subject to widely varying soil, climatic, and grazing conditions, and usually are without protection from the weather. All of this affects the quality and shrinkage properties of the wools.

Wools grown in Texas, California, and Oregon are generally known by the name of the state in which they are produced. Arizona and New Mexico wools also are generally classed sepa-

¹ From James W. Christie, "Grading Wool," *Farmers' Bull.* 1805, U.S.D.A., 1939.

rately because wools from these states have certain distinguishing characteristics. About two-thirds of our wool production is territory wool.

SEMIBRIGHT WOOL. Wools produced in Oklahoma, in the eastern parts of Kansas, Nebraska, South Dakota, and North Dakota, and in parts of Missouri, Iowa, Minnesota, and Wisconsin have a dark or stained color caused by deposits in the fleeces of bits of the soil. The fleeces thus affected appear dirty and unattractive, but they scour out white.

Semibright wools often are grouped and graded with territory or with bright wools, according to their predominating characteristics.

BRIGHT WOOL. Bright wools are produced in the states east of the territory and semibright areas, extending to the Atlantic seaboard. These wools are less exposed to colored soils and other foreign matter than are those in various western areas, so the fleeces are much cleaner and brighter. Such wools have fairly uniform shrinkage, whereas wools from the semibright and territory regions have widely varying shrinkages.

SOUTHERN WOOL. Wools grown in the southeastern states are of bright color and in this respect are similar to bright wools produced in the states east of the territory and semibright regions, but they are designated by the trade as southern wools. Many so-called southern wools are inclined to be brashy, run-out, and uneven, as they are shorn from sheep belonging to no particular breed or class.

In some of the southern states, however, especially in Kentucky, Virginia, and Tennessee, where better strains of sheep are raised, some choice wools are produced that grade three-eighths and quarter blood. Very little wool of the fine grade is produced in the southeastern states.

TEXAS WOOLS. In wool quotations, Fine Texas Wools are listed separately. These wools from the range areas of Texas are sold in the original bags. Such wools are mostly bright in color and moderate in shrinkage, except in the Panhandle district, where they are considerably darker in color and heavier in shrinkage.

Occasionally wools grown east of the range country are called "domestic wools," but this should refer to wool grown in

this country as compared with imported wool. "Fleece wool" or "native wool" is used to designate wools from the farm states east of the range region.

MISCELLANEOUS FACTORS IN THE CLASSIFICATION OF WOOL

While fineness of fiber (grade), length of fiber, and origin are related to the usefulness and market value of wool, several other factors may influence the use or value of a fleece.

In this miscellaneous class are found wools designated by special terms to indicate certain characteristics.

1. **PULLED WOOL.** Wool removed from the pelts of sheep after they have been slaughtered is classed as "pulled wool." The wool is sorted according to color, length, and grade. Shears are used to remove the wool which is not readily pulled, such as that on the head. After pulling, the wool is dried and sacked. Since pulled wool has been partially cleaned of foreign material, it will sell for a higher price than similar grease wool. For a ten-year period, 1929-1938, 15 per cent of our wool production was pulled.

2. **BLACK AND GRAY WOOL.** These terms are used on the market to describe colored wool. Black fibers in the wool prevent its use for white materials. Colored wools are desired for certain uses and may even command a premium at times.

3. **CARPET WOOL.** The wool of this class is long and coarse and resembles hair. Very little of this wool is produced in this country.

4. **OFF WOOLS.**¹ These are defective fleeces. They are otherwise known as discounts, rejections, or unmerchantable wools. Among the wools that are generally classified by the trade as off wools are fleeces in the following conditions: burry, seedy, chaffy, cotted, black and gray, dead and murrain or merrin, and tags.

Burry, seedy, and chaffy are descriptions applied to wool which has excessive quantities of burrs, seeds, chaff, or other vegetable matter entangled in the fibers. When this condition exists additional chemical or mechanical treatment is necessary.

¹*Farmers' Bull.* 1805, U.S.D.A., 1939.

Cotted fleeces are those in which the fibers have become badly tangled or matted. Hard cots or soft cots are terms denoting the degree of tangle or mat in the fibers. (The English form is cotts.) Special mechanical treatment is usually necessary to open these fleeces when preparing them for the manufacturing process.

Black and gray are terms used in the market to describe colored wools. The first is usually applied to that which is nearly all black, and colored fleeces containing relatively large quantities of white, brown, or gray wool are designated by the last term.

Dead wool is wool that has been clipped from sheep shortly after their death. When wool is recovered from decomposed remains found on the ranges, it is designated by the term "murrain" or "merrin."

Tags are parts of the fleece heavily matted with dung and other animal or vegetable impurities. The term "tag locks" is sometimes applied to such discount wool.

Off wools are of inferior quality, and the quality of many is further impaired by the severe cleaning process necessary to put them in usable condition.

PHYSICAL CHARACTERISTICS OF WOOL OF DIFFERENT BREEDS

A study of the physical character of wool diameter, length, crimp, stretch, and breaking strength has indicated significant breed differences. A tabulation of a summary by Darlow and Craft¹ follows:

<i>Breed</i>	<i>Diameter, Ten-thousandths of an Inch</i>	<i>Length, Milli- meters</i>	<i>Crimp per Inch</i>	<i>Stretch, Milli- meters</i>	<i>Breaking Strength, Decigrams</i>
Oxford Down	10.9	107	6	8	179
Southdown	8.9	63	10	6	112
Hampshire	9.3	80	8	7	134
Shropshire	9.2	87	7	7	129
Dorset Horn	10.8	94	7	7	167
Rambouillet	6.6	64	14	6	70

¹ A. E. Darlow and W. A. Craft, "The Physical Characteristics of Wool Fibers from Different Breeds of Sheep," *Bull.* 225, Oklahoma Agr. Exp. Sta., 1935.

The fibers relatively large in diameter, such as those of the Oxford Down, are also longer, have fewer crimps per inch, greater stretch, and greater strength. Fibers smaller in diameter were shorter, had more crimps per inch, less stretch, and less strength. Even from a sample that is from one breed the larger fibers in diameter are longer, more elastic, and stronger.

WOOL STRENGTH AND NUTRITION

Wool growth is like growth of other body parts. The quantity and also the quality may be affected by feeding at a low plane of nutrition. A sufficient amount of feed to maintain good

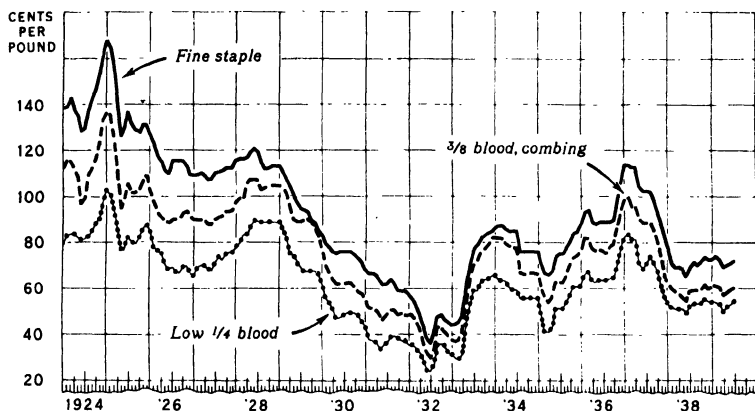


FIG. 232. Wool prices at Boston. Territory wools, on the scoured basis, have fluctuated sharply in price. Mill consumption, which reflects demand for wearing apparel, is the important factor in the price of domestic wool. Fine wool sells higher than coarser wool generally. (U.S.D.A.)

health will permit normal growth of the fleece in amount and quality. Periods of underfeeding or sickness give rise to weak or tender spots in the fiber which detract from the commercial value of the wool. Good feeding will give heavier fleece weights, also wool that is longer, stronger, loftier, and more distinctly crimped. Accelerated growth of the wool fiber often takes place in the early summer owing to luxuriant and highly nutritious pasture. Lambing and suckling may retard the rate of growth of wool fiber. "Tender wool" and "hunger fine" result from poor nutrition or sickness. Such wool is always classed as "clothing wool."

PRICES OF VARIOUS CLASSES AND GRADES OF WOOL

Generally, fine wools sell for higher prices than coarse wool and long wools out-sell short wools, but such is not always the case. Fine wool may be substituted for coarser samples, but the coarse wool can not be made into fine wool fabrics. There being a demand for each kind, the price of a kind depends upon the amount available for the demand. (See Figure 232.)

The differentials in price for various classes and grades for a yearly period are shown by the following tabulation. Also, year comparisons can be made. Wools in the grease were about 5 cents higher in 1940 than 1939.

WOOL—AVERAGE PRICES AT BOSTON FROM CROP AND MARKETS
Calendar Year 1940, Compared with 1939
(In cents per pound)

Classification	Scoured Basis						Grease Basis	
	Territory		Semibright Fleece		Bright Fleece		Bright Fleece	
	1940	1939	1940	1939	1940	1939	1940	1939
Fine:								
Combing (staple)*	96.3	82.7	93.2	80.5	95.9	83.2	38.0	32.0
French combing	91.2	78.4	....	....	....	....	....	....
Clothing	85.8	73.0	85.3	73.4	86.7	75.2	31.6	27.2
Half Blood:								
Combing (staple)	91.6	78.4	86.4	73.4	88.2	75.5	38.5	33.4
French combing	87.7	74.4	....	....	....	....	....	....
Clothing	82.6	70.6	....	....	....	....	....	....
Three-eighths Blood:								
Combing	79.7	69.3	76.4	66.4	77.3	67.8	41.2	36.2
Clothing	75.4	65.0	....	....	....	....	....	....
Quarter Blood: Combing	74.6	65.2	71.4	63.7	72.6	64.0	41.3	36.3
Low Quarter Blood	76.1	62.6	70.3	60.0	71.9	61.4	41.0	35.5
Common and Braid	72.8	59.9	....	....	68.0	59.1	39.3	34.3

* Delaine in grease wool.

Prices of wool over a period of years have moved in cycles of about nine years each.

Wool Cloth Manufacture

The longer wools or "combing wools" are in greater demand than the shorter wools which are known as "clothing wools."

WORSTED AND WOOLENS

In the wool manufacturing industry the longer wools are used for "worsted" materials. There are two systems of worsted manufacture, the "Bradford" and the "French." In the former, long staple is required, while in the latter wool as short as 1 inch may be used; consequently, there is a separate class for French combing wools. The short wools are used in the manufacture of "woolens."

COMBING WOOL

One of the first processes in the manufacture of materials from wool is that of *combing*. In this process the fibers are arranged to lie all in the same direction and combed together into a ropelike strand of yarn known as "wool top." The longer fibers are the *top*, which is used for worsted, which requires smooth, twisted yarns. The part combed out is called *noils*, and this is used in making woolens. In making woolens the fibers are interlaced or laid in as many directions as possible. Such wools are carded and spun into soft, fuzzy yarns for soft woven materials.

CLOTH YIELDS

Since more of the short fibers are usable in woolen than worsteds, it takes more wool to make a pound of worsted cloth than woolen cloth. It requires about 3.7 pounds of grease wool to make one pound of the usual wool cloth. An average size three-piece man's suit requires about 3.5 yards of cloth. If the cloth weighs 16 ounces per yard it would require about 13 pounds of grease wool to make a suit of clothes.

PREPARATION OF WOOL FOR CLOTH¹

There are seven main steps in the preparation of wool for cloth.

The first is the growing of good wool. This is achieved by proper feeding, handling, and breeding. Good wool should have uniformity of fiber size, strength, color, luster, and reasonable cleanliness.

¹ Adapted from Mary Brandon Potts, *Classification, Grades and Uses of Wool*, U.S.D.A., A.H.D. No. 13, 1935.

The second step is the shearing of the wool from the sheep. This is usually done by machine and should be done on a clean floor. The shorn fleece should be tied flesh side out with paper twine.

The third step is "sorting" the wool, that is, dividing it into lots according to fineness, length, character, color, and spinning qualities.

The fourth step is "scouring," which removes the grease and dirt from the wool.

The fifth step is the removal of burrs and other foreign matter. Carbonization is resorted to, if necessary, to remove vegetable matter from the wool from which such material has not been removed by combing. In this process the burrs, etc., are charred by acid, such as sulphuric, and then removed by crushing and dusting.

The sixth step is "carding," that is, passing the wool through a carding machine, a large iron frame on which are a series of iron rollers covered with leather in which slightly bent wire teeth are set. The wool is passed from roller to roller and is finally reduced to the size of untwisted yarn.

The seventh step in the case of woolens is the spinning operation which twists the fibers together, giving them strength and making them into yarn.

In the case of worsteds, there is a combing operation which passes the wool through circular combs. In this process the fibers are laid parallel. The combs separate and draw off the long fibers called "tops" in a continuous length. The remaining short fibers are called "noils."

SHODDY

"Shoddy" is the term used for reworked wool.¹ There are many different kinds of shoddy, reflecting the range of materials used in its manufacture. It is made of cloth trimmings and rags which are sorted, torn up, and finally put through a garnetting machine, which is similar to a carding machine. As garnetting is a more severe process than carding, fibers are broken to some extent. The shoddy is blended with longer staple wool when it is spun into yarn.

¹ Some restrict the term to reused wool.

WOOL PRODUCTS LABELING¹

In 1941 a federal "Wool Products Labeling Act" became effective. One purpose of this act is to protect producers, manufacturers, distributors, and consumers from the unrevealed presence of substitutes and mixtures in spun, woven, knitted, felted, or otherwise manufactured wool products.

Wool products with certain exceptions must be labeled to comply with the law. The label must have the information listed below in nontechnical terms and in type big enough to be easily read.

1. The amount of new wool in the fabric.
2. The amount of reprocessed wool.
3. The amount of reused wool.
4. The amount of each nonwoolen fiber in more than 5 per cent of the fabric; such nonwoolen fabrics as rayon, cotton, silk, etc., may be used with the wool, and they are referred to as *other fibers*.
6. The percentage of weighting, filling, or other adulterating matter.
7. The name of the manufacturer and/or the distributor or seller.

New wool is virgin wool that has not been previously used or worn. Reprocessed and reused wool have been previously described. The terms "reprocessed" and "reused" do not necessarily indicate serviceability or wearing quality, as such wools may actually outwear poor new wool. Wool woven twice loses in strength and resiliency; consequently, reworked wool is inferior to new wool of comparable grades.

WOOL CLASSIFICATION AND USE²

The following is a list, grouped according to fineness of wool, of the more common breeds of sheep, together with a description of the kind of wool each produces and the uses to which it can be put in the manufacture of cloth.

¹ U.S.D.A. *Consumers' Guide*, Vol. 7, No. 15, p. 5, May 1941.

² Mary Brandon Potts, *Classification, Grades and Uses of Wool*, U.S.D.A., A.H.D. No. 13, 1935.

<i>Breeds</i>	<i>American Grades of Wool</i>	<i>Numerical Grades of Wool</i>	<i>Uses</i>
Merino and Rambouillet	Fine and half blood	58's and finer.	In making fine dress goods and flannel.
Southdown	Half and three- eighths blood combing and clothing (chiefly three- eighths blood clothing).	58's and 60's in the half blood. 56's in the three- eighths blood	The half blood wool is used mostly for fine dress goods. The three-eighths blood for the manufacture of cloth such as serges, twills, whipcords, and herringbones used for coatings and suitings.
Corriedale Dorset Hampshire Shropshire Suffolk	Mainly three- eighths blood combing or clothing and some quarter blood (both fine and coarse classes of me- dium wool).	56's in the three- eighths blood. 48's and 50's in the quarter blood.	Used mostly in the manufacture of suitings.
Cheviot	Usually quar- ter blood combing (that is, the coarse side of me- dium wool).	48's and 50's.	Used mostly in the manufacture of suitings.
Oxford	Quarter blood and low quar- ter blood combing (that is, the coarse side of me- dium and the fine side of coarse wool).	46's and 48's.	The quarter blood is used in the manufacturing of suitings, and the low quarter blood is used in making such materi- als as heavy overcoats, blan- kets, and carpets.
Cotswold Leicester Lincoln Romney	Low quarter blood, com- mon and braid.	Chiefly 46's, 44's, 40's, and 36's. A small percentage produce finer than 46's.	Used mostly in the manufacture of heavy overcoatings, blan- kets, and carpets.

Wool Marketing

WOOL SHEARING AND PACKING

Shearing begins in February in the southwest, gradually moves northward, and is generally completed in May. Weather conditions affect materially the time of shearing. In the South shearing may precede lambing, but for the most part it follows lambing. In the sheep states shearing is done by machine.

shears and by professional shearers, who may average from 160 to 170 sheep in a ten-hour day.

Shearing is usually done but once per year, except in parts of Texas, California, New Mexico, and Arizona. The wool sheared twice a year ranges from 15 to 25 per cent of the wool production of Texas. The main factors which influence the fall shearing are (1) range conditions, (2) demand for short wool, (3) financial position of the growers. Fall shearing increases slightly the yield of wool, and lessens slightly the death loss but it does not affect the body weight or the size of the lamb crop. Twice a year shearing may be necessary in roughly hilly country, or when the range is heavily infested with such weeds as catclaw.

Shearing close to the hide to get a long staple is desirable and second clips are to be avoided, as it affects the fiber length and also gives some very short fibers.

After shearing, the individual fleece is tied up with twine. Paper twine is the most desirable tying material because it can be removed intact and fragments remaining in the fleeces are removed in scouring. Loose fiber twines are undesirable, as the sisal or jute from which they are made may persist in processing and show up in the woven material.

In this country wool is usually packed for shipping in large sacks up to 7 feet long which may hold 250 to 400 pounds of wool, or up to 40 fleeces. Wool in the world trade such as from Australia is made into bales weighing 325 to 350 pounds which may contain 40 fleeces each. The Australian and New Zealand wools are generally scoured before they are sold by the producer. Most of our wool is scoured at or near the place of manufacture into cloth. Freight rates favor this practice, and our wools are sorted before scouring.

METHODS OF SELLING WOOL

The wool grower may have one or more of the following avenues of marketing at his disposal:

1. **THE LOCAL BUYER.** Many small clips are sold to local buyers who may buy on their own account or as local representatives for a wool agency.

2. **THE WOOL MERCHANT.** Most of the wool in this country

is handled by wool merchants. Such merchants store, grade the wool, and then sell it to the manufacturer.

3. ORDER BUYING. Wool merchants make purchases for manufacturers on order. The merchant purchases the wool from the grower for delivery at a future date to the manufacturer at an agreed price.

4. THE MILL BUYER. Some mills buy direct from the growers, although the volume handled in this manner is rather small.

5. SELLING ON COMMISSION. In this method the wool is consigned to a wool merchant who acts as agent for the grower, and sells the wool to mills on a commission basis.

6. COOPERATIVES. These function as sale agencies for wool growers, and through wool pooling assume the services usually performed by a middleman.

7. AUCTIONS. Selling wool by auction is common in some countries, but such sales are rare in the United States.

COOPERATIVE WOOL MARKETING AGENCIES¹

Since wool producers have not always been too well satisfied with returns from wool sales, many cooperative agencies for wool marketing have been formed. Wool growers are in general not too well acquainted with wool marketing practices and the factors that influence wool price. Some have secured help in solving problems by joining cooperatives. Through the united efforts of a group, large quantities of wool are pooled at a warehouse, graded, and then sold. Cooperatives are grower owned and controlled, and the trained employees manage the enterprise. All cooperatives do not perform the same functions. Some merely assemble a clip and sell to the highest bidder, while others assemble, grade, and market the wool in an orderly manner.

The important activities of a state cooperative wool marketing association are ² (1) making preshearing loans to its members, (2) assembling carloads of wool at various shipping points for grading or shipment to a central concentration point in the state or to Boston, (3) grading the clips and submitting

¹ L. B. Mann, "Western Cattle and Sheep Areas," *Bull.* 3, U. S. Farm Credit Administration, September 1936.

² Alva H. Benton "Wool Marketing," *Bull.* 252, North Dakota Agr. Exp. Sta., November 1931.

a statement to each member on the grades of his wool, (4) making advances on graded wool to members, (5) supplying wool twine and wool sacks to members, (6) shipping the graded wools to the national wool marketing corporation at Boston, (7) securing cash advances from the national wool marketing corporation on the security of wool graded and shipped, (8) distributing the final returns to the members after the wool of the various grades in the seasonal pool has been sold.

Cooperative marketing associations pool the wool of their constituents. The wool then loses its identity of ownership on grading, and a member is given credit for the grade and weight of the wool he pools. As each member's wool is graded, the producers having higher grading wool will receive higher prices. The main objectives of the pooling are to keep the cost of marketing low and to secure the full market price for the wool. When wool prices are falling, a grower may receive more for his wool by an outright sale at shearing time, but when the reverse prevails price appreciation is secured by pooling. The seasonal low price for wool is from April to June when wool is being marketed. Cooperatives are another marketing agency in the field and provide an alternate marketing method. A cooperative may, through pooling and storing, avoid the usual low time of wool prices.¹

THE NATIONAL WOOL MARKETING CORPORATION

This corporation is a "pool of pools" which was organized November 19, 1929, by a group of wool and mohair growers at San Angelo, Texas. Cooperative groups of wool growers, local, state, or regional, may have a membership in this National Wool Exchange. The organization through the control of a large volume of marketed wool tends to increase the bargaining power of the growers and also stabilize the marketing of wool.

PRINCIPAL WOOL MARKETS IN UNITED STATES

The principal market for wool, both domestic and imported, is Boston, where nearly three-quarters of our wool clip and over one-half of the imported wool is marketed. Since Revolu-

¹ The Ohio Wool Growers Cooperative Association reported in 1940 that in 19 of the past 23 years, consignors have made money by pooling their wool. Net returns have averaged 2.7 cents per pound yearly above usual price.

tionary days Boston has been our leading wool market. This is because most of the manufacturers of woolens and worsted in this country are located within a few hundred miles of Boston. Other important wool markets are St. Louis, Philadelphia, Chicago, and New York.

WOOL TARIFF

There has been an import duty on wool since 1816 with the exception of two periods, which aggregated ten and one-half years in length. There is also a tariff on manufactured goods or compensatory duties comparable to the duty on wool. The tariff is higher on some grades, particularly the fine wools, as noted from the following:

Carpet Wools

- (1) If used for carpets or boots, duty free.
- (2) If used for other purposes, 24 cents per pound clean basis.

Wools of Merino and English Blood

- (1) 40's and coarser — duty free.
- (2) 44's — 29 cents per pound clean basis.
- (3) Finer than 44's — 34 cents per pound clean basis.

There is an additional 3 cents per pound duty on wool scoured before importation.

It was previously noted that comparatively little carpet wool is raised in the United States and the bulk of our home-grown wool is 48's or finer. The duty appears to be fully effective on medium wool most of the time and quite effective on fine wool. The difference between import parity price and prices realized, for a 12-year period, was about one-fifth of the wool duty. In other words, about four-fifths of the duty was reflected in price increase and the remainder was due to other factors affecting wool prices. Annual imports of apparel wool have been declining for a recent period.

MOHAIR

The long, lustrous fiber from the Angora goat is known as mohair. It is readily distinguished from wool by its absence of serrations and natural crimp. The mohair fiber is smooth and

straight. In size the fiber is about the diameter of that of long wool sheep. It is more glossy in appearance than wool, and though mohair has no felting qualities, it is the second most used animal fiber for materials.

The Angora goat is a native of Asia, and goat raising is centered in the district of Angora. The Turks domesticated Angora goats more than 2000 years ago, and they are used as a source of milk, meat, and material for cloth. Our flocks were established from importations made from Turkey.

The mohair industry has been expanding in the United States. Production doubled from 1920 to 1930, and imports practically ceased. In 1940 there were 4,241,000 goats clipped which yielded an average yearly clip of about 5.0 pounds each. The total production was over 21 million pounds grease basis, and the average price was 49.7 cents per pound. The total income from the sale of mohair exceeded 10 million dollars for the year. The Union of South Africa and Turkey follow the United States as leading countries in mohair growing.

It will be noted that Texas is the heavy mohair growing state. Its production is confined principally to the Edward Plateau. For a two-year period 86 per cent of the entire production was grown in Texas. New Mexico, Arizona, and Oregon follow Texas in the order named. Mohair is shorn twice a year in Texas, Arizona, New Mexico, and California, and fall-shorn hair is preferable. Angora goats are used especially upon rough land and can be raised upon land unsuited for cattle or sheep. Goats tend to browse more than cattle and sheep; consequently, they are often used to clean up brush.

MARKET GRADES OF MOHAIR. The finest quality of mohair is from young goats and is called "kid." The usual divisions on the market are as follow.

1. Kid — No. 1 and No. 2.
2. Combing — No. 1, No. 2, No. 3, No. 4.
3. Carding — fibers too short to comb.
4. Stained.
5. Inferior — which includes burry, gray kemp, etc.

USES OF MOHAIR. Mohair is used extensively in the manufacture of materials (plushes and braid) for chairs, seats for

furniture, automobiles, and railway cars. Tropical suitings, dress linings, knitted outerwear, and novelty fabrics are made from mohair. Its outstanding features in material are its brilliancy and durability. Cotton is generally used as a base and the mohair is used for the pile.

OTHER ANIMAL FIBERS USED IN MATERIALS

Wool and mohair are not the only animal fibers used in material manufacture. These are used to blend with wool and other materials in cloth making. Other similar fibers are:

1. Alpaca shorn every two years from alpacas which are raised principally in Peru.
2. Vicuna which is shorn from animals of the same name in Peru and Bolivia.
3. Cashmere, which is the product of the Cashmere goat, raised in the Himalayan Mountains in Asia.
4. Camel's hair is also used in materials and is obtained commercially from China and Russia.

Chapter 35

SHEEP FEEDING AND MANAGEMENT

Although grazing is common with sheep both in the range country and in farm areas, feeding and management on the range are vastly different from that of the farm flock. Large size bands of sheep predominate in the west on the range, where it is not unusual to handle flocks of from 1000 to 3000 head. In the farming sections from 25 to 50 ewes are common, and sheep raising is combined with other farming enterprises. On many such farms the farm flock fills a place in the diversification of farming. They provide a use for considerable feed which otherwise would not be utilized.

Nutritional Requirement of Sheep

Sheep, like cattle, are ruminants and as a consequence are fitted to utilize roughage. Many sheep are never fed concentrated feeds such as grains but are raised on pasture and hay from weaning time until they are marketed. Ewes in the breeding flocks are fed mostly, and in some cases entirely, upon pasture and hay.

A 120-pound ewe that is pregnant, a suckling ewe, and a 60-pound fattening lamb require the nutrient material as tabulated below according to the Morrison Feeding Standard.

	<i>Dry Matter, Pounds</i>	<i>Digestible Protein, Pounds</i>	<i>Total Digestible Nutrients, Pounds</i>	<i>Nutritive Ratio, 1 to</i>	<i>Net Energy, Therms</i>
Pregnant ewe, 120 pounds					
A. Up to 4 to 6 weeks before lambing	2.3-2.6	0.18-0.21	1.7-2.0	7.5-8.5	1.4-1.7
B. Last 4 to 6 weeks of pregnancy	2.8-3.1	0.23-0.26	2.1-2.4	7.2-8.2	1.8-2.1
Suckling ewe, 120 pounds	3.2-3.5	0.29-0.32	2.5-2.8	6.7-7.7	2.1-2.4
Fattening lamb, 60 pounds	2.0-2.5	0.20-0.23	1.5-1.8	6.7-7.2	1.3-1.6

It will be noted that the suggested amounts of nutrient are increased as the ewe approaches parturition and at the same time the nutritive ratio is narrowed. The suckling period calls for additional nutritive material to supply the needs for milk production. It will be noted that the 60-pound lamb being fattened is allowed much more than half of what is recommended for the 120-pound ewe. This indicates the need for more concentrated feed for the lamb.

It should be pointed out that a ration balanced according to a feeding standard is not always complete nutritionally or entirely adequate. Such standards merely give the amount of dry matter, protein, and energy materials needed. Quality of protein, quantity and quality of minerals and vitamins are also dietary essentials. The mineral elements, calcium, phosphorus, and iodine, may possibly be lacking, likewise vitamins may under some circumstances be inadequate in the feeds. These probable deficiencies should be anticipated in making feed selections, and the feeding standard used as an approximate guide. Generally, however, a ration balanced according to the feeding standard is quite complete and satisfactory if it contains a variety of feeds.

Kinds of Sheep Enterprises

There are three kinds of sheep enterprises, farm or range flock production and commercial lamb feeding. There is some slight overlapping of these divisions, yet each is quite distinct and has distinctive managerial problems. Breeding is involved in the maintenance of flocks, so the operator of a farm or range flock is classed as a breeder, and some of them are breeders of purebreds. To some extent they are feeders, as well, especially the farmer with a flock who finishes lambs for the market. However, this term is usually reserved for those finishing livestock for market.

Sheep as they are a part of general farming plans make possible a more complete utilization of the feeds raised on the farm. On the range, because of their grazing habits, sheep utilize efficiently herbage which would otherwise not be used. Cattle on the range are competitive for the pasture, but there are definite advantages for sheep under certain conditions. Sheep

can range on high mountain pastures and much other land unsuited for other domestic animals.

Divisions of Feeding and Management

Inasmuch as the feeding and management in the range country is so different from that in farming areas, this discussion is divided upon the basis of the farm flock and the range flock. It is not the purpose to cover completely all the matters pertaining to feeding and management. That is beyond the scope of this text, and for such information the student is referred to the specialized works on sheep and feeding listed in the appendix.

A brief discussion of the general principles involved in the various divisions of feeding and management follows.

The Farm Flock

The place of sheep on the farm is to supplement the other farm enterprises and provide a market for labor and feed, including weeds and unharvested crops. A flock of 30 to 40 ewes will be of sufficient size so that the production of lamb and wool can be marketed advantageously. With the development of wool pools and local auction sales the small producer has been greatly helped in his marketing problems. A flock of such size can be handled on an average sized farm, and if the equipment is ample, the care of the flock can be integrated well with other farm work. A flock large enough to utilize economically the feed, the equipment, and building and labor available on the particular farm should be the goal. If the flock is too small, there is a tendency to neglect it in favor of the larger farm enterprises. Also the ram cost would be relatively high. Although the labor requirement for sheep raising is low, neglect is costly with the farm flock and for success attention is necessary at critical periods.

THE FARM FLOCK IN SUMMER

The farm flock in the summer consists of the ewes, their lambs, and the rams. The ewe flocks that have had lambs are generally quite heavily fed until the lambs are weaned. Early finishing and marketing of the lambs is highly desirable. The ewes after weaning the lambs are fed mainly upon pasturage.

During this dry period they are not in need of any special care or feeding. A pasture program which involves cultivated pastures, as well as permanent pastures, is highly desirable. By switching to different pastures of various kinds, succulent, palatable forage of ample quantities may be available throughout the grazing season. In many sections blue grass is the main pasture used. While it may be good early and late in season, it has a semidormant period when it is not very productive. If it is supplemented with such pastures as rye, wheat,



FIG. 233. A farm flock on a midwestern farm. On the farm of Adolph Anderson, Davis, Ill.

rape, and alfalfa, it is possible to work out an all-season grazing schedule. Pasture rotation is essential in parasite control; therefore, old blue grass pastures are to be avoided, especially with lambs.

Flushing or increased feeding prior to breeding is quite commonly practiced on the ewe flock. Liberal feeding at this time is advantageous, especially with thin ewes that have been suckled heavily. It is quite generally believed that flushing will cause the ewes to come in heat earlier, conceive more readily, and have more multiple births of stronger lambs. Experimental proof has not wholly substantiated this claim.

THE WINTER PERIOD

Ewes are commonly bred in the fall. The winter season then coincides with the pregnancy period, which causes extra demands for nutrient material. The requirements for feeds can be met with roughages, especially during the early part of pregnancy. Care should be taken to have leguminous roughages of good quality for the breeding ewes and also to provide some



FIG. 234. Mutton ewes and lambs on pasture. Hampshires on the Buck and Doe Run Valley Farms, Coatesville, Pa.

variety, for if sheep are limited to a single roughage feed, the ration may be inadequate. Field feeds, such as crop aftermaths, corn fodder, stubble fields, etc., when available will prove economical and usually quite satisfactory.

As the lambing time approaches, the ration allowance is increased and supplemental grain feeding is generally advisable. A feed allowance ample to permit a gain of 15 to 30 pounds per ewe during pregnancy is sufficient. The kind of roughage used determines the kind and amount of concentrates to feed. If alfalfa hay or other leguminous hay has been fed liberally during

the winter, home-grown grains are sufficient. If, on the other hand, a nonleguminous roughage has been fed, concentrate feeding should start earlier in the pregnancy period and protein concentrates may be needed. Concentrate feeding adds to the cost, therefore the amount should be ample but not excessive. For an average sized ewe about 20 pounds of concentrates and 400 to 600 pounds of dry roughage are needed for the winter period of five to six months.

Exercise is likewise to be stressed in wintering the pregnant ewes. Close confinement is to be avoided and regular exercise made the rule.

LAMBING TIME WITH THE FARM FLOCK

The lamb crop is usually born in the late winter and early spring with the farm flock. Early lambing is preferred as the lambing then does not conflict with the spring work on the farm, and if the lambs come early enough they can be marketed as genuine spring lambs. The early lambs require more attention and equipment than late lambs and also more feed other than pasture. The early lambs tend to avoid stomach worm infestation and can be finished before the summer decline in lamb prices if they are properly fed and handled. Late lambs may cost less to raise, but they usually sell on a lower market than early lambs. At lambing time the feed allowance is restricted and during the suckling period the ration is increased so as to stimulate milk production.

Protection is needed for the ewes with the early lambs. This need not be pretentious, as a dry, well-bedded barn free from drafts is about all that is required. Sheep, even young, can stand considerable cold but are quite susceptible to harm from cold rains or wet snow.

THE BREEDING RAM

In small flocks the ram is to be handled the same as the ewes during a considerable part of the year. Rations and management that are successful for ewes will also be satisfactory for rams. Special feeding prior to breeding time, as was suggested for the ewe flock, is advisable for the ram. The ram should be

in good condition during the breeding season which requires ample nutrition.

GROWING AND FATTENING THE NATIVE SPRING LAMB

The early days of the lamb's life are a very critical period and require the close attention of the shepherd.

Docking and castrating may be done simultaneously when the lambs are 10 to 14 days old.

Lambs start to eat supplementary feeds when they are about two weeks old. A lamb creep arrangement will permit feeding special feeds to the lambs without interference from the ewes. Grain feeding is essential to finish the lamb for an early market. Good pasture has a high value for young lambs. Even though an excellent ration be fed the suckling ewe and the lambs be creep fed also, the addition of good forage will promote faster gains and give a higher finish. Likewise, pasture feeding, if clean and comparatively free from parasites, will give more economical gains than dry lot feeding.

SHEEP ON THE FARM

Compared with other livestock enterprises in farming areas sheep rank high in pasture and roughage utilization and fertility maintenance. On most farms sheep raising is a minor enterprise, consequently it does not provide a market for great amounts of feeds, especially concentrates. Properly handled, the farm flock will contribute substantially to the farm income.

The Range Flock

The following concerning the feeding and management of the sheep on the range is adapted from "Range Sheep Production," *Farmers' Bulletin 1710* of the U. S. Department of Agriculture.

The range sheep unit, or band as it is called, may vary considerably in size, but is usually composed of from 2000 to 2500 sheep. From lambing time until weaning approximately 1200 ewes with their lambs are kept together in a band. After the lambs are weaned, two bands of ewes are combined for the breeding and winter feeding period.

With slight variations and one notable exception, the sheep producers of the western ranges use the same general system in

handling their sheep. They give a band into the care of one herder who, with his dogs, stays with the sheep day and night throughout the season. He is quartered in a wagon equipped for his needs, except during short periods when he is near headquarters or in the summer when he takes his sheep to high mountains where his wagon cannot follow. In this case he uses a tent. A camp tender, with his wagon and team or pack animals, attends to the herder's needs by supplying him with food and moving his camp as the sheep exhaust the grazing in



FIG. 235. A band of yearling ewes on the range. At the Mackey Sheep Company, Boise, Idaho.

the immediate vicinity. One camp tender takes care of two or more herders, depending on the distance he must haul supplies and the roughness of the country. In large organizations a range foreman usually is in charge of several bands on his particular allotment of range, whereas in smaller outfits of one or two bands the owner may take the place of both the camp tender and the range foreman. Additional help is required seasonally, especially during lambing and shearing.

The exception to this general method is found in some parts of the southwest, particularly Texas, where sheep are kept in paddocks or pastures. Here the operators own or have long

leases on nearly all their grazing land, an arrangement which enables them to build fences and let the sheep graze undisturbed in these large pastures. They employ fence riders at all times and additional help during lambing, but on a year-round basis one man can attend to a much larger number of sheep than he can under the herder system.

BREEDING

The time of breeding in different localities varies, depending largely on range and weather conditions during lambing, but the general principles involved are very similar throughout the range country. The sheepman desires that all ewes be bred to lamb in a short space of time, thereby ensuring a lamb crop of reasonably uniform age. He also desires a good percentage of lambs. To obtain these results the progressive sheepman is coming to realize that it is essential to have a uniform band of thrifty ewes, good vigorous rams, and a breeding range with plenty of feed.

The number of ewes allotted to one ram on the range varies greatly, but ordinarily best results are obtained when three rams are allotted to each 100 ewes. The length of the breeding season also may vary, but the rams should be left in at least from 35 to 40 days.

WINTER HANDLING

The range sheepman may choose between wintering on the range and wintering in the feed lot. Most range sheep are brought into the feed lot at some time during the winter. The time varies considerably, depending on the condition of the sheep at the beginning of the winter, condition of the range, the quantity of feed available, and the severity of the winter. In some particularly favored locations and during mild winters the sheepman may allow his flock to graze for the entire winter.

SPRING HANDLING

The largest problem confronting the range sheepman in the spring is lambing. His success at lambing time always has a very definite bearing on the income derived from his business.

SHED LAMBING

Early shed lambs are raised in many parts of the west for the purpose of getting the lambs on the market at a date somewhat ahead of the large run of range lambs. These lambs shipped late in the spring and early in the summer arrive at the markets at a time when the demand is brisk, the supply small, and prices relatively high. For successful lambing late in the winter or early in the spring it is necessary to have, in addition to sheds and other equipment, an abundant supply of feed and sufficient early range forage to finish the lambs after turning them out on the range. During lambing time an abundant supply of good hay and grain is necessary, and some form of succulent feed is highly desirable.

The main advantages of the shed system of lambing are: (1) the band may be lambed early before grass comes, and the lambs may be marketed correspondingly early; and (2) more care can be given to the band during lambing, resulting in a greater percentage of lambs raised. The number of lambs marketed commonly is well over 100 per cent of the number of ewes nursing lambs in the band.

Sheds may be constructed of lumber, galvanized iron, canvas, or straw, or large tents may be used. The interior arrangement of lambing sheds varies with almost every outfit, but the principle is the same in all. Small individual claiming pens, or "jugs," are provided where the ewe and new-born lamb can be placed. Then a system of pens is arranged so that as the lamb grows older the ewe and lamb are gradually combined with larger numbers of ewes and lambs. It is desirable, if not absolutely essential, that all the pens in which the lambs are placed after they are a few days old be provided with a shelter and an outside run.

It is not always possible but it is highly desirable that space be provided in the shed for the lambing band. In cold stormy weather many lambs may be saved by having the lambing band under shelter. By some crowding the band can be accommodated in a space providing a minimum of approximately 6 square feet per ewe, but more space is preferable. Ample ventilation is essential, which may be provided by doors, windows, and overhead ventilators.

RANGE LAMBING

In range lambing the sheepman plans to have his ewes begin to lamb as soon as grass is available in the spring. A part of the range which contains suitable feed, shelter, and water is set aside for lambing, and the ewe band is moved in shortly before the lambs are due to be born. When the first lambs are born the day's drop, with the ewes, is gradually brought together before night, and the rest of the ewe band is moved away under charge of the herder. Flags or scarecrows are set up near the group of lambs and ewes, or fires are built to protect it from coyotes during the night. Similarly the lambs born on the bedground at night are left by the main band in the morning. These small groups of ewes and lambs are given the best possible care, weak lambs are helped to suck, and as they become a little older and gain in strength they are combined until small bands of ewes and lambs are made up and given into the care of herders. Because these young lambs are not able to travel long distances it is necessary that feed and water be close by.

Small tents are frequently used to protect ewes with newborn lambs during storms. Because of a lack of shelter and less individual attention, losses on the range are a great deal heavier than in shed lambing. It is not unusual to lose practically all the lambs born during a severe stormy period.

Sheep and Lamb Feeding

In the fall of the year a great many sheep and lambs from the range country can be profitably used for further feeding. Lambs predominate for this purpose because of the greater margin which usually exists between feeders and finished individuals. The consumer prefers lamb to mutton and likewise will pay more relatively for finish in lamb than mutton. Lambs make as large or nearly as large gains as older sheep and consume considerably less feed, consequently the feed cost of their gains is cheaper than that of older sheep. Lambs will need from one-third to one-half less feed for their gain than yearlings. On the market, feeder lambs are higher priced than yearlings. Although the number of stock sheep in the country has not shown any pronounced long-time trend, the sheep and lambs on feed have shown a decided upward trend.

A demand for feeders arises in the fall because of the accumulation of a season's crop. The corn belt farmer uses the feeder as a means of disposition for his roughage and concentrate feeds. The western feeder in the intermountain region feeds beet by-products and similar feeds which become available in the fall. In the estimates of sheep on January 1 each year the number on feed is nearly 6 million head. (See Figure 236.)

It has been noted previously that the movement of feeders and stock sheep and lambs is peaked in the fall. Lambs from California may be available as feeders in May, and those from

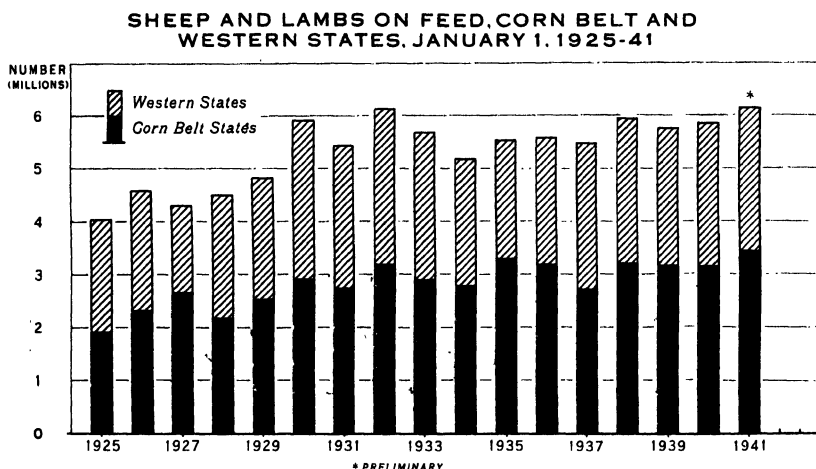


FIG. 236. Sheep and lambs on feed January 1. Lamb feeding has increased and about 50 to 60 per cent of the lambs fed are fed in the corn belt. (U.S.D.A., Bur. of Agri. Economics.)

Texas may be on the market as late as February. Conditions on the range affect the movement of the feeders. With a shortage of range pasture the marketing is early. Geographical distribution of the feeder receipts is based on the termination of the range or pasture season.

WHERE ARE FEEDER SHEEP PURCHASED

It has been noted previously that the large markets for feeders are near the range. The feeder may buy at the public market or direct. Since 1930 direct marketing of sheep and lambs for feeding has increased sharply. Contract feeding,

which has also increased in the same time, is a form of direct marketing. In feeder lambs it is quite common for a dealer to contract with a sheep rancher for his entire band of lambs. The dealer then sorts and sells to individual buyers.

In the farming states feeder sheep may be available locally and in relatively small lots. When feeder lambs are purchased at public stockyards markets many are shipped to the place of feeding by railroad. The feeder lambs are generally purchased in lots of 150 head, the usual capacity of one deck in a car. Truck shipments are made in smaller numbers.

LAMB FEEDING AREAS

Sheep and lambs from the producing and grazing areas are sold for slaughter or if they are to be fed they may go to the winter pasturing and feeding sections or the feeding areas. In the latter areas roughage and concentrate feeding is practiced. The northwestern Colorado area is typical of this kind. Up to one million lambs are fed annually in this area, the principal feeds being alfalfa, beet pulp, and corn. An example of the winter pasture and feeding section is the southern Kansas winter wheat pasturing and feeding area. Winter grazing on the winter wheat is practiced, and the supplemental feeding is varied with the condition of the wheat. The western sheep areas are described in *Circular C-103* of the Farm Credit Administration.

LARGE LAMB FEEDING STATES

The state destination of inspected feeder sheep shipped from the public stockyards may indicate the extent of sheep feeding within a state. This includes only shipments from public markets and does not cover direct shipments.

Following is a list of some of the leading states in numbers received from the public stockyards for a recent ten-year period (1930-1940) and also the average number shipped yearly.

1. Nebraska	573,045
2. Iowa	408,555
3. Colorado	406,246
4. Missouri	179,332
5. Illinois	174,214
6. Kansas	160,486
7. Minnesota	111,553

The distribution and marketing of sheep and lambs on feed in the western states and the corn belt has been previously noted. (See Figures 206 and 236.) Nebraska and Colorado fed lambs are marketed from February to April, and the feeding is largely done on a large-scale basis. Corn belt lamb feeding is done by farmers who usually operate on a moderate scale and by some commercial feeders who handle large numbers. The latter group commonly operates through the year. Farm-fed lambs are marketed mainly in December, January, and February.

Lambs kept until shearing time are often shorn and sold as sheared lambs. Conflicting results on the value of the practice have been the finding of the experimental tests. There seems to be no great difference in the feed lot response with lambs before and after shearing. A comparison of the market prices of woolled lambs, sheared lambs, and wool will indicate the probable profitability of the practice in a given year. The feeder should consider the shearing cost as well as the estimated return for the fleece. Lambs fed until late spring or early summer are kept more comfortable if they are shorn, and if warm weather prevails the response from feeding may be enhanced.

FEEDING PLANS WITH FEEDER LAMBS

The feeders offered on the market are of a great range in type, breeding, and weight. These differences in the feeder sheep determine to a large extent the system of feeding to be used. McDonald ¹ has described various groups of feeder lambs available on the markets and suggested appropriate feeding methods as follows:

Black-faced lambs vary in weight from 60 to 75 pounds. The lighter, thinner lambs finish rapidly in the feed lot and can put on a lot of gain on pasture before they are placed in the dry lot. Those weighing over 70 pounds must be finished quickly so that they will not be penalized on the market because of excess weight. Black-faced lambs running under 60 pounds are likely to be unthrifty.

White-faced crossbred lambs range in weight from 55 to 75

¹ C. W. McDonald, "Buying and Feeding Lambs," *Ext. Circ.* 230, Iowa State College, December 1940.

pounds. Like the black faces, the heavier lambs need to be crowded so that they will not be too large, rough, and coarse when finished for market. They feed well but do not finish as rapidly as the black-faced lambs.

A class of lambs called quarter bloods (one-quarter black face) ranges in weight from 50 to 75 pounds. These lambs often show a mottled colored face. They are strong and vigorous open-faced feeding lambs with a comparatively tight fleece.



FIG. 237. Western lambs in the feed lot on a corn belt farm.

The lighter weight lambs of this breeding are more suitable for a long feed.

Rambouillets, often called white faces, tight-wooled lambs, or fine wools, vary greatly in weight and in type and conformation. They range in weight from 50 to 80 pounds and vary in type from a comparatively smooth meaty type approaching the quarter bloods in conformation to the heavy, wrinkled kind with wrinkles on the neck and body.

Where the wrinkles predominate, the wool must often be sheared from around the eyes to prevent wool blindness. This

kind is perhaps the least desirable type of feeding lambs. They fatten slowly and are discriminated against on the market because of the heavy pelt and low dressing percentage. Contracts for purchasing lambs usually state that there shall be no wrinkled lambs, along with the stipulation that there shall be no bucks, long tails, or light lambs under 40 or 50 pounds in weight.

There are two kinds of smooth type, open-faced Rambouillets: the tight-wooled kind, and the more open, fluffy fleeced lambs. Both kinds are hardy and thrifty but feed somewhat more slowly than the black-faced or crossbred lambs. Their gains, however, are about as economical.



FIG. 238. Finished range lambs. First prize range lambs, 1940 International Live Stock Exposition. Bred and raised by T. J. Drumheller, Patrick, Wyo.; fed by Ralph Fulton, Ashton, Ill.

Many feeders prefer the tight-wooled white-faced lambs because they are thrifty and lighter in weight since they have been raised on scanty ranges where the black-faced and crossbreds do not thrive.

Most of the feeder lambs available in Texas, Arizona, and New Mexico are of Rambouillet breeding. Here, too, the smooth-bodied lamb, free from wrinkles and skin folds, is much preferred over the heavier pelted lamb. Smooth-bodied lambs of straight Delaine breeding are not so desirable for feeding as are the Rambouillets since they are smaller framed and do not have the capacity to make rapid gains.

Native mutton type lambs may sometimes be picked up locally or may be purchased on central markets. Naturally

lambs assembled in this manner would be less uniform in quality, weight, and thrift than western lambs. These lambs, to be successful in the feed lot, must be treated for stomach worms. When so treated and fed in small bunches they make acceptable feeding lambs. Their gains have ranged from 20 per cent less to equal gains with choice western feeding lambs. To be profitable they must be purchased at a price enough lower to make the margin between buying and selling price considerably greater than for western lambs.

Native fine wooled lambs of Delaine breeding consume less feed daily than either native mutton lambs or western lambs. They gain more slowly and require more feed per 100 pounds of gain. Because of the heavier pelt they yield less, and the finished lot will probably run 10 to 15 per cent more culls than either native mutton or choice western lambs. If they can be bought at enough price differential, drenched for stomach worms, and given a longer feed they make acceptable feeding lambs.

FEEDS USED FOR FATTENING LAMBS

The farm-fed lamb in the corn belt is fed mainly on corn and oats, and satisfactory rations are supplemented with such feeds as legume hay, a protein supplement like linseed meal, and frequently corn silage. A 60-pound lamb fed a 100-day period will gain from 30 to 35 pounds in the feed lot. For this gain 2 to 2½ bushels of corn and 130 to 170 pounds of legume hay will be needed, and if a protein concentrate is used the consumption of it will be from 15 to 20 pounds per lamb. Farmer feeders fatten lambs either in the dry lot or in the fields, where the lambs clean up — such as corn fields or stubble fields, or fall pasture.

Commercial feeders of lambs use a greater variety of feeds than is common with farm-fed flocks. Likewise they use many by-products or special feeds. Commercial feeding of sheep first started with the use of screenings from flour mills for feeding. Now many lambs are fed in part on the by-products from the manufacture of beet sugar, such as beet pulp and beet molasses.

Hand feeding or limiting the feed allowance is the usual method with lambs.

Self-feeding is practiced only when the roughage and concentrate can be mixed and fed together. When the lambs are given free access to concentrated feeds, they will overeat and the death loss may be quite high.

The fattening of western lambs is not so different from the finishing of native lambs. The same general principles apply and, in the corn belt, the same feeds are used. With the native lamb it is usually a case of growing and fattening, while with the western lamb the period on the range and while suckling is mainly one of growth. Fattening is delayed until the lambs are put into the feed lot.

DEATH LOSSES IN LAMB FEEDING

Extreme care must be taken in the feeding and management of feeder lambs. The grain allowance, if excessive — that is, over two pounds per lamb daily — will cause disturbances which result in death losses, as will also unusual conditions, such as abrupt changes in feed. A death loss up to 3 per cent is not unusual with feeder lambs during a 90-day feeding period.

To avoid death losses pasture and roughage are used in starting the lambs and concentrated feeds are introduced slowly into the ration, only after the lambs are well started. An inexpensive open shed will do for shelter, but dryness overhead and underfoot is highly essential. Clean fresh water constantly available is necessary for good results with lambs.

RISKS IN LAMB FEEDING

Feeding of commercial lambs is attended with some risk because of the death loss and other causes. The margin between feeders and finished lambs can not be predicted accurately. This, then, is an element of uncertainty. Feed prices, too, are uncertain and they may be a factor in the financial outcome. Exclusive of the cost of the feeders the feed cost is the largest single item in the enterprise. Weather, too, may also be a factor in the way in which lambs feed out. All items considered, lamb feeding is a speculative venture. To a large extent success is dependent upon buying the feeders worth the money, and selling on a good market.

Lamb Feeding or Farm Flock

In farming areas the farm operator may either have a farm flock or do lamb feeding or both. With sheep production shifting to the range areas more unfinished lightweight lambs are available for feeding, and farm feeding has been on the increase. With the farm flock, the summer grazing of the flock makes use of pasture and assists in the control of weeds. Such flocks consume principally pasture and roughage, and there is the twofold income — lambs and wool. Labor, too, is utilized throughout the year with the farm flock.

Lamb feeding is preferred by some over farm flock maintenance because it is more flexible. In fact, if the feed supply is short, or the ratio of feed prices to finished lamb prices unfavorable, the lamb feeding can be omitted. Usually less trouble is encountered from internal parasites with lambs on feed than with the farm flock. Experience is a valuable asset to the lamb feeder, and it is somewhat risky to secure it with a large lot of feeder lambs. To attain experience a small farm flock has a distinct advantage.

Managing the Sheep Flock

Skillful management is highly essential for success in the sheep enterprise. Attention especially at the critical periods of breeding, lambing, and weaning pays good returns with sheep. Likewise, careful attention is necessary to disease and parasite control, and to proper feeding and management of the breeding flock and the lambs. The ability of the operator is more of a factor in sheep raising than with other kinds of livestock.

Whether the enterprise be that of range or farm flock or sheep feeding, certain considerations influence its outcome. The capable manager manages the sheep so that the objects for which they are kept are attained. The plan of production to be successful must include taking into account the following:

THE USABLE FEED SUPPLY

As sheep are kept mainly to give a market for home-produced feed, a careful estimate of the probable feed supply will indicate the reasonable limit of sheep breeding and feeding. Purchased feeds at times may be necessary, especially supplements, but

in general on the ranch or the farm the home supply of feed may be regarded as the factor limiting expansion. Costs of marketable feeds and their returns sold as sheep or lamb gains must also be estimated from time to time to determine which is the most profitable outlet for the feed supply.

THE EQUIPMENT REQUIRED

Great losses may occur when the housing is inadequate. Sheep can normally withstand cold weather, but need protection against rain, sleet. Inexpensive buildings that are dry, well-ventilated, and convenient are desired. Lambing time needs are also to be anticipated by the good manager. Equipment, other than housing, aids in handling the sheep more effectively and with less labor.

THE LABOR INVOLVED

One man can care for a relatively large number of sheep with good equipment and proper aids. On the farm the labor needs may be dovetailed with the labor needs of the other farm enterprises. On the range the flocks are divided into units which can be handled by one sheep herder.

THE MARKET OUTLOOK

The outlook for sheep, lamb, and wool is continually changing. The sheep raiser has two markets to watch — sheep and wool. A good manager will anticipate demands, seasonal variations in prices, and market accordingly. The feed situation, livestock on feed, and outlook for lamb and wool are given in U. S. Department of Agriculture reports, and are of inestimable value in shaping sheep production to future market situations.

KEEPING RECORDS

Careful records are helpful in studying results and to determine which phases or practices are profitable or unprofitable. A breeding record, production record, and financial record indicating the main items of expense will be valuable in making future plans for the enterprise. Careful records are imperative with the purebred flock.

PARASITE AND DISEASE CONTROL

One of the greatest stumbling blocks in successful sheep raising is the loss which comes from parasites. Although sheep appear susceptible to disease and lacking in resistance, the loss generally from this cause is not excessive, and as noted previously, slaughter condemnations of sheep from disease are low. Parasites, such as stomach worms, tapeworms, etc., are widespread, and successful sheep management must include parasite control. Phenothiazine is very effective in the removal of several species of nematodes from the digestive tract of sheep, such as the common stomach worm, the lesser stomach worm, the bankrupt worm, the hookworm, the large-mouthed worm, and the nodular worm, and is also slightly effective for some other parasites. Copper sulphate and nicotine sulphate have long been used for the removal of gastrointestinal worms of sheep, and they are effective against the common stomach worm, but less effective with several other intestinal parasites than phenothiazine.

CONTROL OF LOSSES FROM DOGS AND PREDATORY ANIMALS

Many precautions can be taken to safeguard the flock against losses from dogs and wolves. Corrals with "dogproof" fencing are helpful in eliminating such losses.

OTHER DUTIES OF MANAGER

There are also other duties of the manager of a sheep flock. He must know sheep, sheep selection, and also sheep feeding. He likewise looks after such details as shearing, dipping, weaning, docking, and castrating.

Chapter 36

SHEEP BREEDING

Robert Bakewell, previously mentioned as the pioneer animal breeder, improved the Leicester breed of sheep. This breed was used later in the modification and improvement of other sheep breeds. Outstanding because of its ideal mutton conformation, the Southdown, too, has been useful in improving other breeds. John Ellman, Sussex County, England, is



FIG. 239. A typical Southdown ram. This breed is unexcelled in mutton type form. Owned by W. B. Belknap, Goshen, Ky.

credited with being the leader in early Southdown improvement. This work was started in the latter part of the eighteenth century, and his methods, "inbreeding and rigorous culling," were similar to those of Bakewell. Leicester sheep supposedly were used in the Southdowns at an early date.

Since the time of Bakewell and Ellman, many other sheep breeders have attempted to develop superior sheep through a

better understanding of reproduction in the sheep and sheep improvement methods.

For convenience, the subject matter on sheep breeding is divided into the reproductive process, breeds, breeding systems, and breeding stock selection.

The Reproductive Process

With most breeds of sheep there is but a limited time of the year in which the oestrus cycle occurs. Of the British breeds, the Dorset Horn has a very long breeding season. The Merinos, Rambouillets, and Tunis also may have a much longer breeding period than the other breeds.¹ With the other breeds the breeding season extends from August to January. Lambs have a shorter breeding period than older sheep. It is thought that the cool of the autumn nights causes the ewes to come in heat. Another theory is that coming in heat is controlled by the shortness of the hours of daylight, and when the hours of daylight fall below 13 to 14 the ewes come in heat.

Ovulation takes place toward the end of the oestrus or heat period. However, there is some range in time of ovulation as compared with oestrus; it may occur after oestrus has ended. The period of oestrus is about 29 hours in duration and the oestrous cycle is about 17 days. Most of the variations are within the range of the fourteenth and nineteenth day. A ewe then will normally be in heat for about a day's time every 17 days. Much variation has been observed in apparently normal individuals.

Nutrition has been found to affect the reproduction in sheep. Ewes on a low plane of nutrition have a short breeding period, longer oestrous cycles, and a lower rate of ovulation. Shepherds who flush their ewes will increase coming in heat and the number of ova shed if the ewes being "flushed" are raised from a low to a high nutritional plane. It is considered good practice to have the ewe flock gaining in weight just prior to and during the breeding season, rather than standing still or losing weight.

The gestation period in sheep is about 148.9 days in length,

¹ The ewes of these breeds with long breeding periods are used for producing winter or "hothouse" lambs which are off-season lambs, a market for which exists in sections of the eastern states from December to Easter time.

and the standard deviation of individual gestation lengths is 2.3 days. Single lambs are heavier at birth than twins, and triplets are outweighed by the twins. There is also considerable breed difference in birth weight, but generally they average from 8 to 10 pounds.

Ewe lambs are not generally used in the breeding flock. They are usually kept open until they are yearlings. About 75 to 85



FIG. 240. A champion Southdown ewe at the 1938 International Livestock Exposition. Owned by J. D. Larkin, Queenstown, Ontario, Canada.

per cent of the ewe lambs come in heat and can be bred. With mutton type ewes under favorable conditions, the practice may be followed without injury to the flock.

The rams mature sexually before they are one year of age, and many ram lambs are used in the breeding flock. During the nonbreeding season the ram continues to produce sperm, but they are less numerous and active than those of the normal breeding season. Rams overly fat or heavily woolled may be impotent. It appears that spermatogenesis is effected by temperature. A temperature lower than that of the body

cavity is necessary for normal sperm formation. An active, vigorous ram, well fleshed but not fat, is most serviceable in the breeding season. Such rams from one to four years old will settle from 35 to 50 ewes if they are permitted to run with the flock.

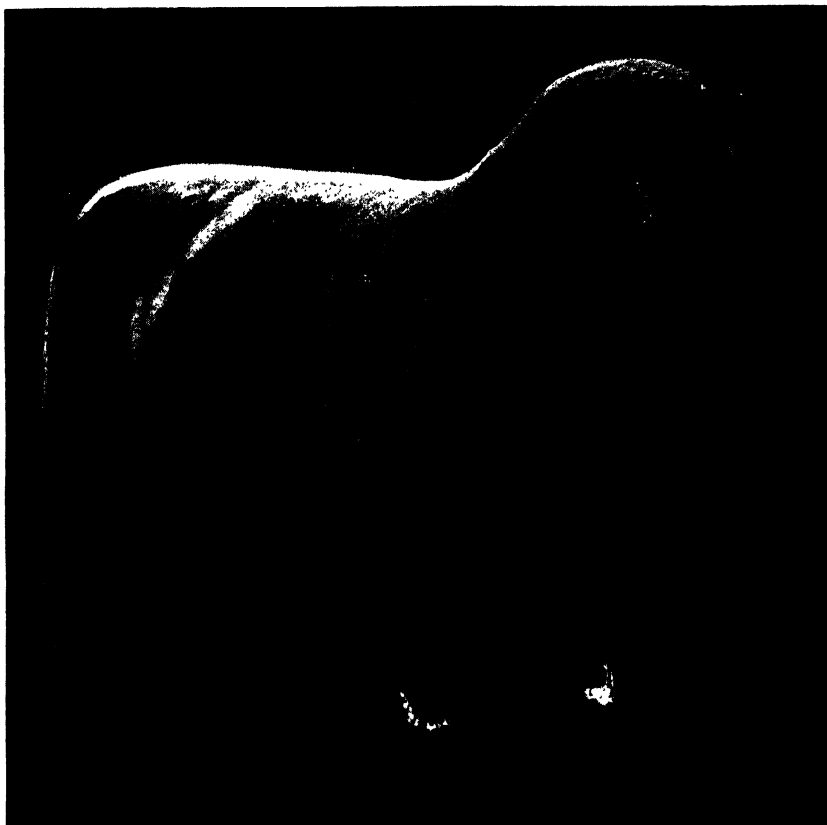


FIG. 241. A typical Hampshire ram. The Hampshire breed is noted for its fast-growing lamb. Owned by W. F. Renk and Son, Sun Prairie, Wis.

MULTIPLE BIRTHS

The number of lambs raised, or lamb crop, may be expressed as the per cent lamb crop, which is the number of lambs raised per 100 ewes. Fertility in ewes is largely determined by the number of ova shed, as prenatal deaths are comparatively infrequent. Breeds vary in their fertility, and nutrition may have an influence upon the lamb crop. The fine wool ewes are

less prolific than the mutton ewes. The larger ewes within a breed are more prolific than the smaller ewes, and the prolificacy increases with age until the ewes are five years old. Twins are more common in some breeds than single births; however identical twins rarely occur in sheep.

With farm flocks of mutton breeding, it is not unusual for 100 ewes to have 150 lambs or more, while in range flocks the pro-

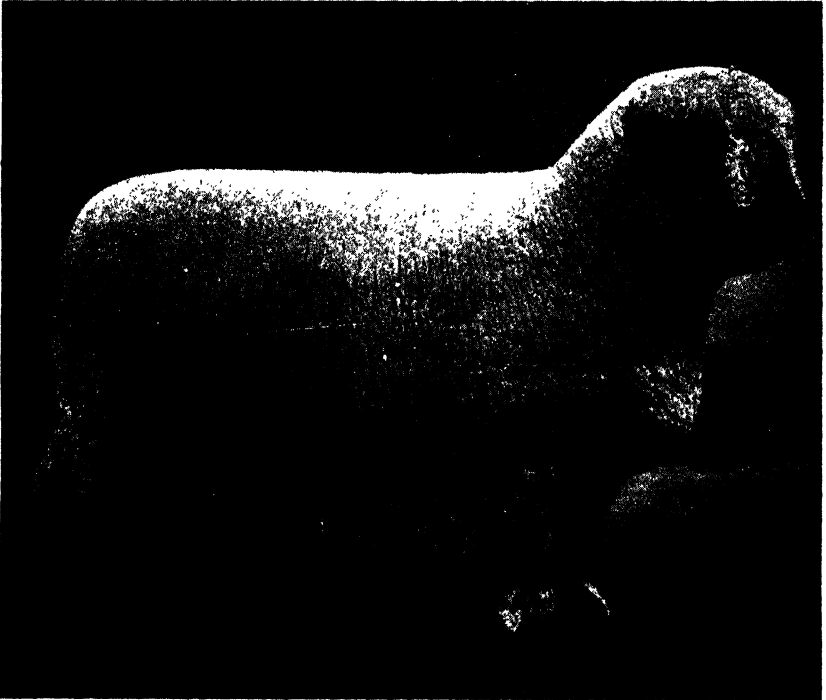


FIG. 242. A medium wool, mutton type ewe. A champion Hampshire ewe shown by Malcolm Moncrieff, Big Horn, Wyo.

lificacy is much lower. In the number of lambs saved as a percentage of the ewes over one year of age in the year of 1938, Iowa led with 112 and Kentucky was second with 110. The northern range states had larger lamb crops than the southern range states on the percentage basis — for example, Wyoming was 87 and Montana 86, while Arizona was 79 and New Mexico 70. For that year the percentage of lambs saved in the entire country was 89. This difference in the farm flocks in the native

sheep states and range flocks in the western states, which was about 16 lambs per 100 ewes, is due mainly to breeding and in part to nutrition.

Occasionally a ewe will have three or four lambs, but usually there are but two teats on the ewe's udder; consequently a ewe is not capable of suckling more than two lambs. Rarely the ewe's udder has four sections and four teats. Selection for the



FIG. 243. A typical Shropshire ram. This breed is noted for its heavy fleece of excellent quality, combined with good mutton form. They are popular sheep for the farm flock. A yearling ram owned by A. Broughton and Sons, Albany, Wis.

multinipple character, with probable increase in prolificacy, has not increased the lamb crop beyond what might be experienced in a prolific mutton type flock.

There are slightly fewer rams than ewes in the lambs at birth, the percentage of males being 49.5.

TIME OF LAMBING

As the breeding is seasonal and in most breeds confined to the fall, the lambing is in the spring.

Off-season or hothouse lambs are the product of ewes from breeds with longer breeding seasons.

ARTIFICIAL INSEMINATION

There has been a considerable amount of artificial insemination practiced with sheep. The semen of the ram is very concentrated, and even though the ejaculate is quite small (about



FIG. 244. An excellent Oxford Down ram. This breed has the largest size of any of the medium wool breeds. A champion Oxford ram shown by W. Duncan, Wilson, Ill.

1 cc.) a large number of ewes (30 to 40) can be inseminated from one ejaculation. Also the sperm can be kept fertile for a longer period of time (about five days) under good conditions than the sperm of other common farm animals. It has been reported from Russia that 2600 ewes were impregnated from one ram in one season. Another Russian report credited the semen of 9 rams as being used on 45,000 ewes, which by normal service would require 900 rams. The ram sperm can be readily transported. Many cases of long-range paternity are on record in

sheep. In 1937 shipments of rams' semen were made from the U.S.D.A. Station at Beltsville, Maryland, to Moscow, Idaho, a distance of approximately 2600 miles, which required on the average 45 hours in transit. The semen was used successfully in impregnating ewes.

A summary by the Bureau of Animal Industry in 1939 reported a total of 309 inseminations made with ram semen that



FIG. 245. A grand champion Suffolk ram, 1939 International Livestock Exposition. Owned by Upway Farms, So. Woodstock, Vt.

was shipped by airplane for distances from 700 to 2600 miles. The semen, which had been kept for periods of 22 to 200 hours, resulted in 31 pregnancies or about 10 per cent of the inseminations.

*Sheep Breeds*¹

Sheep breeds are still in the making. We are developing breeds suited to our conditions, such as the Columbia, Panama,

¹ For a complete discussion of sheep breeds refer to texts listed in the Appendix.

Romeldale, and Targhee. We have also imported the Corriedale from New Zealand, which is a comparatively new breed.

Most of our mutton breeds are of English origin; the single exception is the Tunis from Africa. The breeds from Great Britain are roughly of two general types. The large type sheep from England is a long wool sheep. In this group we have such breeds as the Lincoln, Cotswold, Romney Marsh, and Leicester,

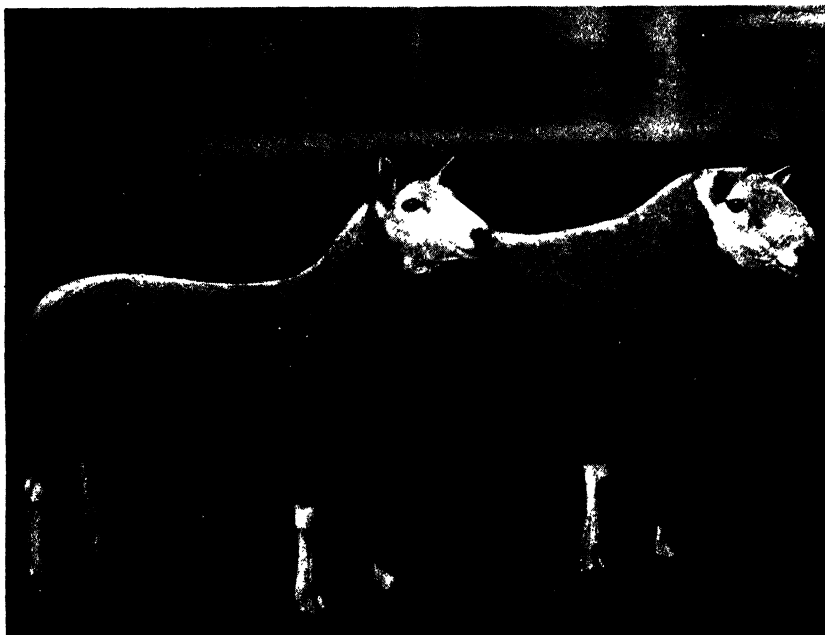


FIG. 246. A champion Cheviot ewe and ram. Michigan State Fair. Shown by Ben D. Kelly, Marshall, Mich.

which were developed in the low fertile sections. The smaller type of sheep from England is in the medium wool class and includes the so-called "down breeds." The common breeds of this group are the Southdown, Shropshire, Hampshire, Suffolk, Oxford Down, and Dorset Horn. These breeds were developed in the upland regions for herding on the commons and downs. The upland regions were joint pastures that were used before the advent of fencing, and the downs are the chalk hills of England such as the Southdowns and Midale downs. The

wool type breeds came originally from the Spanish Merino. However, we have formed two wool type or fine wool breeds, the American Merino and the Delaine.

ADAPTABILITY OF VARIOUS SHEEP BREEDS

Sheep breeds were developed under various conditions which affect their general adaptability. Very significant differences

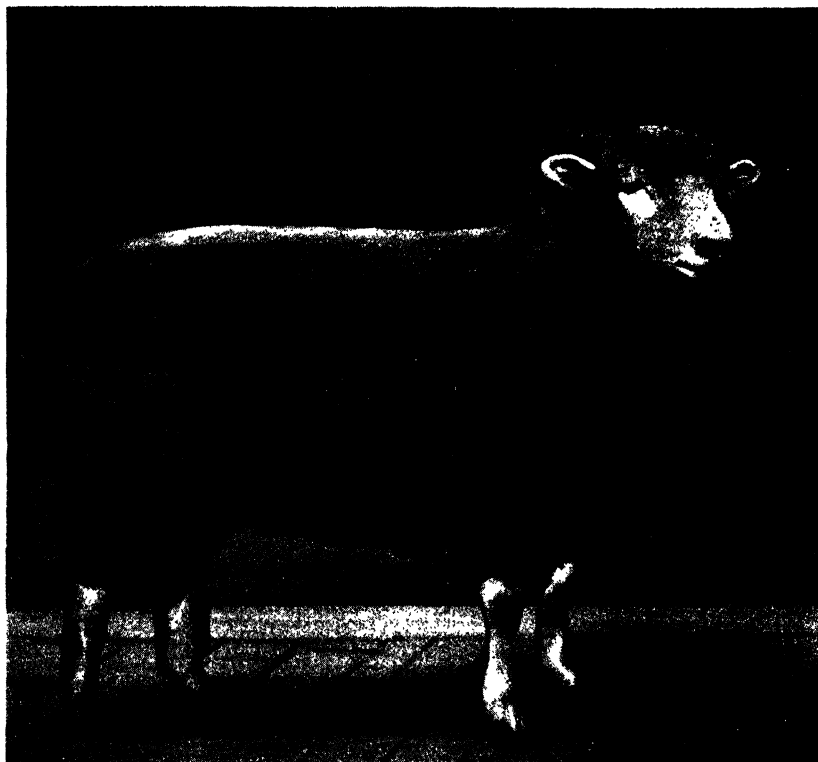


FIG. 247. A champion Dorset ewe. Dorset ewes, because of their long breeding season, are often used for hothouse lamb production. Owned by W. E. Huff, Lexington, Ky.

are evident between sheep breeds; for example, breeds are significantly different in length of gestation period and parasite infestation. Some of the subtypes have a general adaptability. The long wool sheep were raised in a low-altitude, ample-forage area where heavy feeding prevails. Such sheep are therefore

heavy feeders and do well under conditions such as prevail in their native home. Fine wool breeds like the Merinos and Rambouillets do better under more adverse conditions than the long wools. They are suited to range conditions and are not so adversely affected by inadequate rations as the other sub-type. In an attempt to secure a more meaty conformation, the



FIG. 248. A Corriedale ewe. King Bros. Co., Laramie, Wyo.

Rambouillet and the Delaine Merinos were developed from the Spanish Merino which was strictly of the wool type. Medium wool sheep like the long wools were developed mainly for meat production in Great Britain. As contrasted with the long woolled sheep, the medium wool sheep were generally raised at higher elevations and under less liberal feeding conditions. In both cases, wool was a secondary product. On lands where the

grazing is poor to fair, fine wool is produced, but the lamb or mutton is poor to fair. On more productive lands better mutton and lamb are produced, but the fleece is classed as medium wool.

The climatic conditions, soil, altitude, and natural feed are factors in determining adaptability as well as the production demanded. Constitution, hardiness, and prolificacy to a large



FIG. 249. A grand champion Lincoln ram at the International Livestock Exposition. Owned by H. M. Lee, Highgate, Canada.

extent determine the usefulness of a sheep. In general, the breed to choose is that which is suitable to local conditions and meets the requirements of the available market.

Breeding Systems

Sheep raisers may use a breeding system based upon the relationship of the individuals in the flock such as grading up, crossbreeding, or inbreeding. Likewise, breeders may control the matings and, on the basis of the resemblance, follow assortative mating, such as breeding like to like.

The use of the various breeding systems is of long standing in sheep husbandry. Bakewell practiced inbreeding with his Leicester sheep, and crossbreeding was also used.

GRADING UP

Purebred rams have been extensively used in the improvement of the lamb crops from common or scrub stock. If the flock is comparatively poor, the best way to bring about improvement is through the use of a good sire. By the retention of the graded-up ewes, the merit of the flock is increased. Each successive step increases the value of the offspring roughly by one-half over that of the poorer parent. As the flock is bred up the improvement made in the offspring by each newly introduced purebred sire is lessened, and if an inferior sire is used the herd merit will decline. After two or three purebred crosses, there seems to be little difference between the purebred and the high grade. Within any pure breed great differences are noted. For example, in such kinds of production as can be measured objectively, as fleece weights, lamb crop, daily gains, all flocks of a breed are not the same.

USE OF PUREBRED MUTTON RAMS ON NATIVE EWES

In many sections of the southern states, a very inferior type of sheep is found, and these are referred to as "natives." This term is also used to designate farm-raised sheep on midwest livestock markets.

The changes in meat and wool characteristics resulting from the use of purebred mutton rams on native ewes has been studied at the North Carolina Agricultural Experiment Station.¹ The ewes used in this experiment were described as follows. They were unusually small, with narrow, poorly shaped bodies and long legs, and their legs, bellies, and faces were bare of wool. The wool on the body was short and coarse, lacked uniformity in color, and contained considerable hair. In fact, the only desirable features possessed by these native sheep were their hardiness and early breeding habits. These ewes were mated to

¹ J. E. Foster and Hostetter, "The Changes in Meat and Wool Characteristics Resulting from the Use of Purebred Mutton Rams on Native Ewes," *Tech. Bull.* 60, North Carolina Agr. Exp. Sta., April 1939.

Shropshire and Hampshire rams which were representative of the better type that have been used to sire market lambs. Shropshire rams were used the first three years, Hampshires the next two, and native eastern North Carolina rams the next four breeding seasons. The half-blood Shropshire and Hampshire ewes from the first cross were bred to other rams of the same breed. The findings of this investigation are summarized as follows:

A vast improvement in meat and wool characteristics resulted from the use of both Shropshire and Hampshire rams on native ewes. (See Figure 250.) Greater size and more rapid gains were obtained in the Hampshire crosses than in the Shropshire crosses, but the latter excelled the former in compactness and quality of form and in weight and quality of fleece. The second and subsequent crosses did not show as great an improvement over the preceding crosses as did the first cross over the natives, but noticeable improvement continued, especially in conformation, quality, breed characteristics, and quality of fleece, until it was difficult to distinguish them from purebreds. The grades never equaled the purebred Hampshires either in size or in rate of gain, but they did in grade of market lambs.

Satisfactory and useful farm ewes were developed from rams



FIG. 250. Two ewe carcasses. The larger carcass is from a second cross yearling mutton ewe, while the other is from a three-year-old native ewe. Two top crosses of purebred mutton lamb on the native ewes made a decided change in mutton form. (Earl H. Hostetter, North Carolina University.)

of both the Hampshire and Shropshire breeds, and the methods used proved practical for the development of a grade farm flock.

The ability of the purebred to improve the merit of the flock is clearly demonstrated by this and also other experiments. Purebreds are being improved, breed improvement rather than expansion is being stressed so that the purebred breeders may have still further improved breeding stock to offer the commercial grower.

CROSSBREEDING

Sheep raisers have in many instances resorted to crossbreeding to form new breeds. The Oxford breed, for example, was formed from a Hampshire Cotswold cross. This same method has given us the Corriedale breed, and we have several breeds recently formed in this country by this method. During the formative period the breeds from crossbreds are not uniform, but before long they breed true and the offspring conform quite consistently to the accepted breed type. Forming a breed by crossbreeding requires large numbers and several generations to arrive at the desirable combination of genes. When the new ideal is intermediate between two breeds in desired characteristics, crossing would give the desired characters, and then by inbreeding the uniformity or homozygosity could be established.

Crossbreeding is extensively used in producing market lambs. This is an old practice in England and quite widely used in this country. The crossbreds have the hybrid vigor. It is possible to get qualities in the crossbred lambs which may be advantageous for market lambs. In range flocks, for example, Rambouillet breeding has many advantages, and ewes of such breeding will produce highly acceptable market lambs when bred to mutton type rams. Miller¹ crossed Rambouillet ewes with rams of several breeds. He found that the lambs sired by the Hampshire and Suffolk rams were the largest, with those of the Shropshires next, while those of the Southdown, Romney, and Rambouillet were about equal and the smallest.

Breeds of the mutton type are less suited to range conditions than fine wools. Consequently on the range the ewe flock of

¹ Robert F. Miller, "Crossbreeding Investigations in the Production of California Spring Lambs," *Bull.* 598, California Agr. Exp. Sta., 1935.

fine wool breeding is preferred. Such ewes are hardy, long lived, good grazers, can subsist on short pasture, and produce a good fleece. The lambs from mutton rams of early-maturing breeds on wool type ewes will bring a better price on the market than purebred, fine wool lambs. Crossing is therefore practiced when market lambs are selling well. The crosses of the medium wool rams on range ewes are not retained in the breeding flock because they may lack the herding instinct and hardiness that are essential in the range flock. Sheep ranchers who cross, therefore, breed enough of the ewes straight to supply ewe flock replacements. Of the medium wool breeds, the Hampshire and the Suffolk have met with favor for crossing, especially under good pasturing conditions. The long wool breeds, especially the Lincoln, Cotswold, and Romney, have likewise been used for crossing on the range flocks. In some areas the crossbred ewes have proved quite satisfactory on the range, which explains the development of new breeds from such crosses.

Although sheepmen can accomplish certain objectives by crossbreeding, the practice may be overdone. It should be used to attain certain ends, and a well thought out system should be followed. Indiscriminate crossing is not to be encouraged.

SPECIES CROSSES WITH SHEEP

Within the group known as sheep, which includes long tailed sheep, fat tailed sheep, short tailed sheep, and fat rump sheep, crosses are made with no apparent loss of fertility. Goats have been crossed with sheep, but early fetal death results. The chromosome complex of the sheep differs from that of the goat to the extent that a hybrid would likely have a dissimilar genetic constitution. Sheep have a chromosome number of 54 while in goats it is 60.

Breeding Stock Selection

The foundation of success in sheep raising is the breeding flock. The perpetuation of a good breeding flock is attained only by careful selection. Selection has been a very effective means of improvement, and it no doubt will continue to be of

great value. However, its maximum efficiency is secured only by the use of the other means of improvement along with it. In other words, selection to be effective should be used with a breeding plan such as grading, crossbreeding, or inbreeding. About 2 to 4 per cent of the rams and 45 to 55 of the ewes in a normal lamb crop are needed for flock replacement. It is therefore possible to cull normally one-half of the ewe lambs and over 95 per cent of the ram lambs.

BASIS FOR SELECTION

We can use, in deciding upon an individual for the breeding flock, the pedigree, the production record, and the individuality. The breeding performance of the individual and its relatives as well as the individual's appearance should form the basis for selection.

The most reliable basis of selection is on actual performance, but the measurement of performance in sheep is difficult and such performance tests as we have require much time. Choices for the breeding flock must be made before performance tests results are available. The pedigree is likewise a valuable aid. Early in the nineteenth century, in fine wool sheep, excessive emphasis was given to pedigree breeding which resulted in excessive speculation.

SELECTION OF BREEDING MUTTON SHEEP ON APPEARANCE

In form, quality, fleshing, and fleece the mutton type breeding ram and ewe should be comparable to the ideal mutton sheep for market as described in Chapter 30. Briefly reviewed, the standard for market sheep calls for a form that is wide, deep, compact, low set, and straight of lines, a quality typified by smoothness in form and fleshing, and a finish and fleshing that is thick, firm, uniform. A fleece that has ample length, density, quality, and condition, and is free from objectionable materials and fibers, is also required. These qualities are wanted in the breeding flock, for a farm flock lacking in these essentials will not produce lambs of high market desirability. Flocks of poor individuality may be quickly modified by the

use of purebred rams of good mutton type and the retention of the better ewe lambs in the breeding flock or grading up. Greater emphasis is given the fleece in the ewe flock because if a fleece of high value is grown it will pay for the keep of the ewe.

SELECTING THE MUTTON BREEDING RAM. The farm flock may be improved most rapidly by the use of good sires. Considering the breeding potentialities of a ram, the additional cost of a ram of merit may be spread among many lambs, if a fair size farm flock is maintained. A ewe kept in the flock for six or seven years may produce 5 to 8 lambs, while a good vigorous ram may be used for from 35 to 50 ewes per year, which would mean 50 to 75 lambs per season. Too often an inferior ram is used in the flock, and it may take years to overcome the defects thus introduced. Slow growth, poor conformation, inferior fleeces, and many other faults are not uncommon in many rams in service.

The ram should conform to the mutton type and conformation. He should have all that is expected in a top market lamb. The ram should be a purebred and of the breed adapted to the area. Under most conditions, the breeding of the ram and that of the ewe should be the same. Crossbreeding is not recommended unless it is carefully planned and directed toward definite ends, and if the crossbred ewes are used rigid selection is necessary for success.

A ram, to be of great value in the flock, must overcome the defects or deficiencies in the ewe flock. Likewise we would specify that the ram be sound and free from defects, be masculine, a good feeder, rugged, good in feet and legs, healthy, early maturing, rapid gaining, and have a good fleece.

Masculinity, or the development of the male characteristics, is due to a testicular secretion which also effects desire and power for mating. This is separate from sperm production which comes from other cells in the testicles. One may be affected without affecting another. That is, a masculine, sexually active buck may not be fertile, and vice versa.

SELECTING THE MUTTON BREEDING EWE. Some considerations other than mutton, form quality, fleshing, and fleece are of importance in selecting mutton ewes for the farm breeding flock. These are size, breed type, sex character, and tempera-

ment. Following is a brief statement of the requirements under each of these headings.

Size. Large size in breeding ewes is desirable provided the size is not so great that the market lamb from such ewes is underfinished when at the desirable market weight. Big ewes of the correct mutton form and weighing 130 to 170 pounds produce larger crops of fast-gaining lambs. Such ewes have heavy fleece and large capacity for feed, and yield large quantities of milk. Rapid growth rate makes for economy of gains.

Breed Type. Ewes typical and representative of the breed will make for uniformity in the flock of size, form, color markings, and fleece, which usually is a distinct asset in selling market lambs. Farm flocks are generally medium wool sheep, and such breeds are widely adapted to conditions in farming sections. However, in some areas Rambouillets, Delaine, or American Merinos predominate in the farm flocks. A breed is chosen mainly for adaptability; consequently the individuals should conform to the breed in essentials.

Sex Character. Shepherds in general show preference for breeding ewes displaying marked secondary sexual characteristics. A refined, matronly appearance yet with sufficient size is desirable. It goes without saying that useful ewes need good-sized sound udders. Maternal instinct and milking qualities are prerequisites for heavy spring lamb production.

Temperament. Nervous ewes may not prove useful in the breeding flock. A quiet, tractable, motherly disposition is desired.

Constitution, Health, and Vigor. Vigor and health are important attributes in a productive and profitable breeding flock. The ewes should have strong constitutions, ample ruggedness, good feet and legs, and be free from defects.

In flock culling age is also a consideration; old ewes or gummers are discarded and in purchasing ewes two and three year olds are preferred. Flock records are useful aids in culling the flock. Only ewes which raised good heavy lambs and are good wool producers are to be kept in the flock. If the flock is culled soon after shearing and before weaning the lambs, shearing records are available.

The lamb or lambs are evidence of production, and the form

is rapidly appraised by visual examination. It has been demonstrated that a higher level of productivity can be maintained in a flock by retaining the ewes raising twins rather than singles.

SELECTION OF WOOL TYPE BREEDING SHEEP

The selection of wool type breeding sheep is different from that of the mutton type as the essentials of the two types differ. Selecting and culling is much the same, but relatively more emphasis is placed upon the fleece with the wool type. The fundamental properties of wool type sheep are discussed in Chapter 31. Since there is not the difference between the

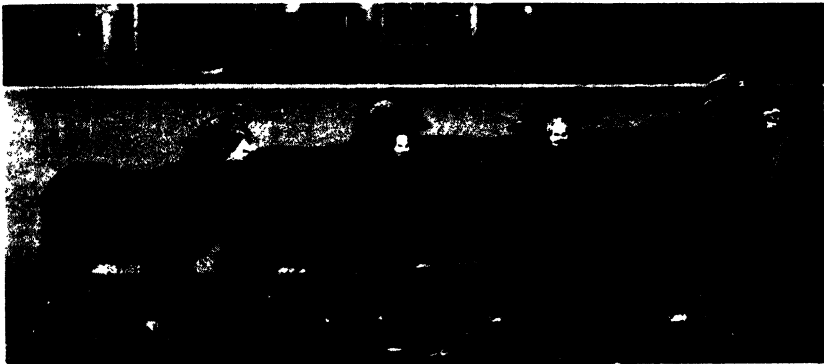


FIG. 251. A Rambouillet show flock. A ram and three ewes.

market and breeding requirement that exists in mutton type sheep, further discussion of selection in breeding fine wool sheep on appearance is unnecessary. Wool type sheep marketed for slaughter or feeding are appraised according to mutton standards.

BREEDING FOR WOOL IMPROVEMENT IN RANGE SHEEP

In the selection for wool improvement with an ordinary band of ewes, the most effective means is to select a ram having the desired type of fleece. The extent that the ram is able to transmit the qualities of the fleece to his offspring is not known, but it may be predicted in part by his pedigree and performance.

A score card for selecting rams lists the points to be con-

sidered in fleece judging. The relative importance of each follows:¹

SCORE CARD FOR THE UNSHORN FLEECE OF RAMS
TO BE USED FOR WOOL IMPROVEMENT

QUALITY OR FINENESS. Producing a grade of wool typical of the breed. Not a mixture of fine and coarse fibers within the staple. Not a wide difference in fineness between shoulder and lower thigh or britch.....	20
LENGTH. Should be clearly of combing length for the grade. If of 12 months' growth, fine wool breeds should produce on the shoulder a staple of $2\frac{3}{4}$ to $3\frac{1}{2}$ inches; medium wool breeds suitable for effecting wool improvement, $3\frac{1}{2}$ to 5 inches; long wool breeds, 6 to 10 inches or over. Little variation in length over the main parts of the fleece. Minimum of short wool..	18
PURITY. No hair, kemp, black, or brown fibers. Cut heavily for beard hairs on wrinkles of fine wool breeds and for coarse hair on the britch of all breeds and crossbreds.....	16
CHARACTER. Fiber evenly crimped throughout, crimp close and distinct, fibers parallel in the staple except for sufficient cross fibers or binders to hold the fleece together. Tips free from wastiness, not frowzy. Soft, springy, and elastic.....	12
COLOR. Light buff color to white. Fairly even in color over main parts of fleece.....	6
CONDITION. Yolk moderate in quantity and evenly distributed in the staple. Not clotted, sticky, or gummy.....	10
DENSITY. Fine wools should be sufficiently dense to prevent dirt from penetrating far into the staple on the shoulder and sides. Avoid loose wooled individuals of all breeds, but remember that <i>extreme</i> density may be associated with short staple....	18
	100

In wool improvement some selection is possible with the ewes, for only about one-half of the ewe lambs are needed for replacements. The touch system of culling is suitable for use in range ewe flock selection. The manner of examination is briefly described below.

"Touch System" of Culling.² A long narrow chute or runway is filled with a part of the ewes to be culled. The man doing the job then works rapidly through this group, grabbing a handful of wool on the back of each ewe. At the same time he notes the general appearance and the condition of the fleece. A chalk is used to mark the less desirable ones, so that they can

¹ J. F. Wilson, "Wool Production and Improvement of the Clip in California," *Circ. 106*, California Agr. Ext. Ser., November 1937.

² Fellhauer Ting, "Two to Four More Pounds of Wool Per Ewe," *Sheep Breeder*, November 1938.

be cut out later. An experienced culler can work over 1000 ewes an hour by this system.

BLACK SHEEP

Several breeds of sheep are naturally black in color. After flocks of black Merinos were established in Australia, black fleeces outsold white fleeces. Occasionally this happens, but usually black and gray wool sells at a discount. Black color occurs in such breeds as the Shropshire and other down breeds and the Merinos. There are complicating factors in the inheritance of black in these breeds, but it is without doubt due to a recessive color factor.

THE PUREBRED SHEEP BREEDER

The function of the purebred breeder is to produce seed stock for commercial raisers. It is a very highly specialized field of sheep husbandry. A knowledge of selection, breeding, feeding and management, as well as the fitting and showing, are essential for success. Not all purebred flocks exhibit sheep at shows and expositions, but fitting for sale is essential for selling to the best advantage. Likewise a purebred flock manager should have salesmanship ability. The showing of a flock at the livestock shows is a form of advertising, and it tends to establish the flock among the breeders. Show winnings of a flock are a measure of the standing of the flock according to show ring standards.

The management and handling of a purebred flock is not the starting place of a novice in sheep husbandry as it is a highly competitive field which, for success, requires experience and the development of skill in all phases of sheep raising and business ability.

Chapter 37

HORSES—GENERAL VIEW

Of our farm animals the horse is regarded by historians as among the first to be domesticated by man. There was a nearly world-wide distribution of the horse in prehistoric times. Fossil remains of horses have been found in Europe, Asia, Africa, and on both continents of America. The wild horse had become extinct upon this continent before its discovery and colonization by the Europeans. It seems quite probable that our modern horse descended from the wild horses of northern Asia.

More has been written about the horse than about our other domestic animals. Rather complete investigation has been made of its origin and domestication. The public interest in horses is indicated by the fact that more than 2000 books relating to them have been published in English.

Evolution of the Horse

Supposedly the horse has evolved in 2 or 3 million years from a small four-toed animal less than a foot in height to its present form. The horse is credited with great qualities of adaptation to its environment. During Paleolithic times horses were quite numerous in Europe, but with the growth of forests in the Neolithic period they became less numerous. The changes of the horse from the small prehistoric *Eohippus*, or dawn horse, to the *Equus* species as we know it today, have been rather completely described. Geological findings form the basis for the piecing together of the evolution, in which the toes were reduced in number, the height and size increased, and the teeth changed materially. This was all accompanied with skeletal and muscular changes in which the horse was converted from a foxlike animal to its present form. The early horse was capable of surviving in the forest, but with evolution the conformation

was better suited to grazing in the grassland country. The change in the foot made for greater adaptability to level rather than rough country, and hard rather than soft ground.

Time of Domestication

Man's use of the horse antedates written histories. Horses were ridden by the Babylonians as early as 2000 B.C., and from there horses were taken to Egypt about 1600 B.C. by the Shepherd Kings from the north. The Chinese were no doubt using horses at a very early date.

Man's Use of the Horse

Man's first use of the horse was as a source of food, which probably preceded domestication. Later, the horse was used as transportation. It was not until the Bronze age that the horse ranked as a domesticated animal. Probably man first herded the horses and then trained them for riding and for beasts of burden. The principal use of the horse to modern man is his ability to do work. Other uses are minor in comparison to his physical power. For centuries horses were used in war not only to transport troops and supplies but as active units in warfare.

During the period when the "knight in armor" prevailed upon the battlefield, good horses with strength and endurance were essential for successful warfare. The knight and his armor would weigh from 350 to 425 pounds, so size ample to carry the weight was essential in the war horse. The Crusaders were impressed by the remarkable qualities of the Oriental horses, and it is said this caused many of the Arabian, Turk, and Barb horses to be taken to Europe to improve the native stock.

The invention of gunpowder and the use of more modern means of warfare shifted the horse toward use for draft purposes. Their use in agriculture for the cultivation of the land is a comparatively recent development. Until about 200 years ago the horse was used almost exclusively for riding.

Place of Domestication

In tracing probable places of origin of the horse many historians have suggested a polyphyletic origin. It is rather com-

monly accepted that the modern horse descended from one or all of the following: the Oriental horse, the wild black horse of Flanders, and the ponies native to northern Europe. One investigator would list as antecedents of the above the Libyan horse of northern Africa, the Mongolian pony of upper Asia and the Celtic pony of Europe.

As is often the case, the foundation is not clear and also there are many gaps in the history. Apparently the smaller horses or ponies were farther north than the larger horses. The original English horses were described as small ponies, shaggy and hardly more than 14 hands high. Subsequent use of Oriental and Flemish stocks increased the size.

Wild Horses in Existence

There is only one family of original wild horses, other than those which are feral or escaped from domestication. This is the wild horse of Asia, the Tarpan or Prejvalsky horse,¹ found in the steppes in Mongolia. They are smaller than the domesticated horse and the young are capable of domestication. In characteristics they are not markedly different from the other family members.

The Kiang and Onager are of the Wild Ass species and are found in the sparsely settled areas of Asia. They have not been domesticated. The domesticated ass was derived from the Egyptian wild ass which inhabits Egypt and Abyssinia.

Zoological Classification of the Horse

The family *Equidae* includes horses, asses, and zebras, which are distinctive from other mammals in that only one toe (the third) is developed on each foot. They are grouped with the odd-toed, hoofed mammals which also include the tapir and the rhinoceros families. The horse is the *Equus caballus*, while the ass is the *Equus asinus*.

Introduction to the United States

The first domesticated horses were brought to the western hemisphere by the early Spanish colonists. De Soto brought

¹ Several spellings are prevalent.

237 horses to Florida in 1539, and some of these were used in his expedition into the middle west in 1544. Coronado in 1540 started an expedition from Mexico which included horses and penetrated to a point near the boundary of Kansas and Nebraska. The American Indians domesticated the llama, the alpaca, and the dog, but they secured their first horses from the Spanish explorers. Wild horses such as are found on the western range, known as bronchos and mustangs, are descended from those domesticated horses. Once introduced on the western plains, the horses increased greatly in numbers as they are



FIG. 252. A lightweight draft team in a pulling contest. Jim and Bob, owned by Burlist Moyer, Greensfork, Indiana. This team weighed 2995 pounds and made a world's record pull in 1940 with a tractive pull of 3275 pounds. (The Horse and Mule Association of America.)

adapted to a grassland environment. The horses of the western plains first came in from Spanish explorers or direct through Mexico, and these were of an Arabian descent. Saddle horses were later brought in along the south Atlantic. The introduction of draft horses was later and it was coincidental with colonization.

When first used in this country, horses served mainly for riding and pack animals. Heavy farm work such as plowing was done by oxen. Wagons were used when moving loads by horses, but it was not until about 1840 that the buggy first made its appearance. Suitability for heavy farm work was one of the contributions of our early horse breeders. The first draft horses imported from France were small in size, being

more like coach horses, but the size was increased in accordance with the draft needs.

Growth of Horse Production

The number of horses increased in the United States up until about 1915. (See Figure 253.) Horse production expanded with the growth and development of farms. The estimated number in 1867 was about 7 million head. By 1913 the horse population had expanded to over 21 million head on farms. For six years, or until 1918, the population stayed over 21 million head. Since

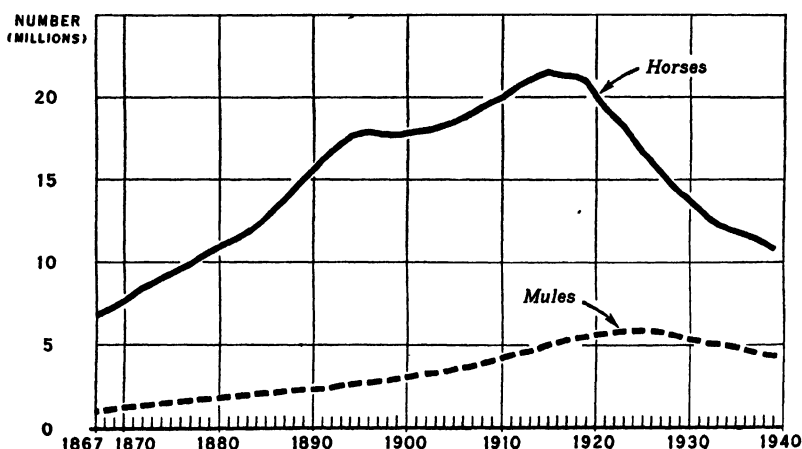


FIG. 253. Number of horses and mules on farms, 1867 to 1939. Horse production expanded and contracted more than mule production. The peak in horse numbers was in 1915, while the peak in mule numbers was ten years later. (U.S.D.A.)

then recession in numbers has been regular and marked. By 1940 the population was but one-half of that of the maximum period, the number being under 11 million head. The increase in the use of trucks and tractors was responsible for the shrinking in numbers of work stock.

Mule numbers have likewise moved up and down. Compared with horses they were later in reaching their peak in numbers and their decline has been less perceptible. We had 1 million head of mules on farms in 1867. In 1925 there were 5.9 million head, and by 1940 the number receded to 4.3 million.

The decrease in horses and mules has had a material effect

upon American agriculture. Considering both horses and mules, the reduction in numbers from 1915 to 1940 was about 11½ million head. This released for other use a considerable amount of crop land which produced feed grain and pasture. In turn this led to the accumulation of agricultural surpluses both in feed supplies and livestock production from the feeds formerly used by horses and mules.

Farms upon Which Horses and Mules Are Kept

In spite of the fact that horse numbers have been reduced one-half in the last two decades, a large number of farms report horses and mules. In 1940 about 72 per cent of our farms had either horses or mules or both. Of the classes of livestock on farms, chickens and cattle were kept on more of our farms than horses or mules. However, horses and mules were on more of our farms than hogs or sheep. Horses were reported on about 52 per cent and mules on 30 per cent of the farms. The number of head per farm was relatively low, it being but 3.2 per farm on farms where horses are kept.

Leading States in Horse Production

Horses are enumerated in the census and in addition the number is estimated annually. The leading states in numbers of horses are as follows.

HORSES — STATES LEADING IN NUMBERS,
1935-1939 AVERAGE ¹

<i>State</i>	<i>Thousand Head</i>
Iowa	853
Minnesota	705
Texas	698
North Dakota	581
Nebraska	569
Missouri	505
Kansas	502
Oklahoma	408
South Dakota	399
Montana	292
Colorado	255
Kentucky	224
California	195
Idaho	186
Virginia	166
United States	11,374

¹ *Agricultural Statistics 1939*, U.S.D.A., p. 363.

The above are the states with large horse populations. This gives no indication of the extent of production over and above requirements. The surplus producing states are mainly in the range area, and in the marketing movement horses move eastward and somewhat to the south.

Types of Horses

The usefulness of a horse is based upon locomotion. From the smallest pony to the largest draft horse we have a multitude

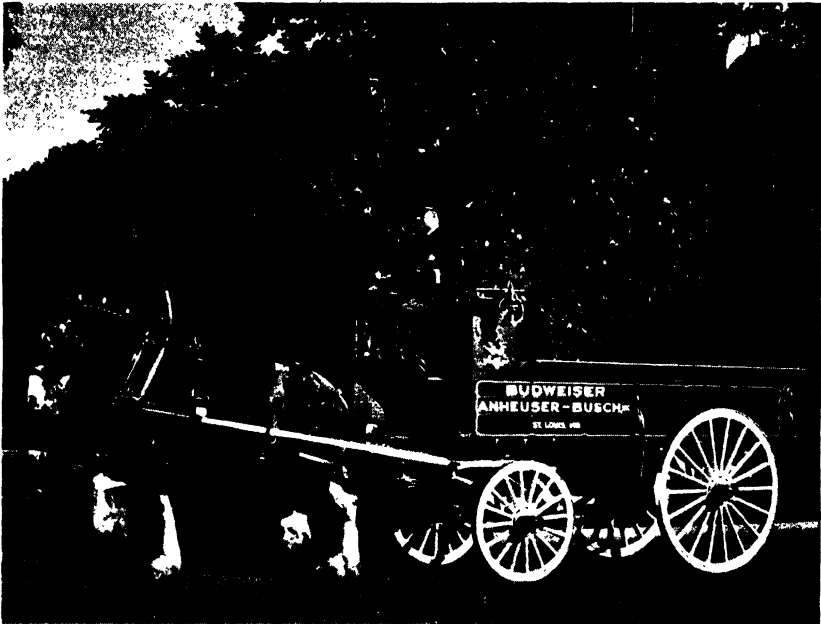


FIG. 254. A draft horse hitched single. Sir James, champion gelding at the International Livestock Exposition. (Anheuser-Busch, Inc., St. Louis, Mo.)

of types and classes. Draft horses are essentially movers of heavy loads, or capable of heavy draft. As they move heavy loads at relatively slow speed, power rather than speed is desired. Conformation which tends to denote efficiency as a drafter, or hauler of heavy loads, is desired in this type. Ordinarily horses are divided into draft horses and light horses. The latter group includes those in between ponies and draft horses in size. They are adapted to a wide range of uses because

of their range in size. It is not uncommon to divide horses and mules into two classes, (1) work animals, and (2) pleasure horses, which includes horses used for riding, driving, and racing.

The types of horses and the breeds in the different types and their place of origin are listed as follows.

<i>Type</i>	<i>Breed</i>	<i>Place of Origin</i>
Draft	Percheron	France
	Belgian	Belgium
	Clydesdale	Scotland
	Shire	England
	Suffolk	England
Carriage	Hackney*	England
	Cleveland Bay	England
	German Coach	Germany
Roadster	Standardbred	United States
Saddle	Morgan	United States
	American Saddle Horse	United States
	Thoroughbred	England
Ponies	Arabian	Arabia
	Shetland	Shetland Islands

* Hackneys meeting the highest requirement are also classed as ponies.

The above breeds were listed separately in the last census which segregated the horses by breed. A sizeable number of horses and ponies were included in the "other and unspecified breeds." Welsh ponies are included in the group as well as the Yorkshire Coach and French Coach. In that census report the French draft breed was included with the Percheron. The Percheron is but one of the draft breeds from France, and at one time there were many of the other breeds here.

Of the 14 breeds given separate listing the Percheron was the most numerous, followed by the Belgian, the American Saddle Horse, and the Standardbred in the order named.

Show Ring Classification of Horses

The show classes for light horses are included in the discussion of the different types. With draft horses we have strictly draft classes and breeding classes. The base date for age classification is January 1.

The draft gelding and mare classes are divided into the ages four years or over, three years, under four, two years, under

three, and one year and under two. Likewise there is usually a champion. There are also classes for draft or farm teams, in pairs, and sometimes four-horse and six-horse teams.



FIG. 255. A good draft team, well matched. (Wayne Jackson, Iowa State Department of Agriculture.)

The breeding classes for purebreds have a general classification as follows:

STALLIONS¹

(Similar age classes are offered for mares.)

- Stallion, five years or over.
- Stallion, four years, under five.
- Stallion, three years, under four.
- Stallion, two years, under three.
- Stallion, one year, under two.
- Stallion foal.
- Senior champion stallion.
- Junior champion stallion.
- Grand champion stallion.

¹ The first prize winners in the three younger classes show for the Junior Championship, while those of the older classes compete for the Senior Championship.

GROUPS

The group classes may include the following:

- Get of sire.
- Produce of mare.
- Mare with own foal.
- Three stallions.
- Three mares.
- Stallion and three mares, any age.

Chapter 38

DRAFT HORSES

The draft horse is essentially a mover of heavy loads by traction. Although on a farm most horses are quite universally general-purpose animals, their main work is that of drawing or hauling heavy loads. In cities the horses formerly in service for heavy hauling have been largely supplanted by trucks. The draft horses are therefore mainly farm horses, and they are called upon to do a wide range of work. Other uses on the farm are for transportation, power, pleasure, and breeding. Horse carcasses have a value; consequently, horses are slaughtered when that return is greater than from other uses. Horse meat is generally used in dog foods and similar products.

There is a relationship between usefulness and conformation in horses, yet it is impossible to measure or estimate all the qualities that affect the drafting ability of a horse. Endurance, durability, and tractability, for example, are not reflected completely in conformation.

The main usefulness of the draft horse being to draw loads, its conformation has been shaped for efficiency in that service. Draft horses perform their work at a walk. Even though certain features that are minimized in the other classes of horses are stressed in draft horse selection, certain characteristics are desirable in all horses and mules. Dinsmore¹ has stated that the desirable characteristics which should exist in all horses and mules, regardless of size or type, are as follows.

1. A strong heavily muscled back, which seems short.
2. A short, wide, strong, heavily muscled loin.
3. A deep chest, wide through from side to side.
4. A roomy middle, due to long, well-sprung ribs, and a capacious abdominal region.

¹ Horse and Mule Association of America, *Book No. 219*. 1935.

5. Well-set legs, pasterns, and feet; that is, these parts should be correct in position, viewed from front, side, or rear.
6. Strong leg joints, deep from front to rear, that are clearly defined, with dense bone of good quality.
7. Straight action and good wind.
8. Good head, eyes, and temper.

We lack objective measures of the performance of draft horses. Judging or selection is an eye appraisal of the working capacity of the horse and includes some considerations which may not be related to ability to work. Perhaps measurements would be more useful than scores or rating, but the relation between work capacity or ability to perform and measurements has not been established as yet.

Detailed Description of the Ideal Draft Horse

USES OF THE DRAFT HORSE SCORE CARD

The draft gelding may serve as the ideal for draft horse score cards, in the same manner as a beef steer was used for the ideal beef type. In horses, however, less disparity occurs between the unsexed males or geldings and the individual mares and stallions used for breeding. In studying the desirable characteristics of a draft horse a score card is especially helpful because of the greater number of points considered in evaluating horses as drafters. The score card is a description of the ideal and its component parts, and it also suggests the weight given to the different parts or features. The parts of the horse are shown in Figure 256. For a proper appraisal of the animal as a whole, a consideration of the major division and parts is useful.

SUGGESTED SCORE CARD FOR A DRAFT HORSE

The draft horse score card is unique in that action is included as a major division, and because in application it is suitable not only for geldings but also for mares or stallions. The latter are used for breeding as well, but little difference exists between the ideals for draft and breeding. As there is an association between form, conformation, and other characteristics and

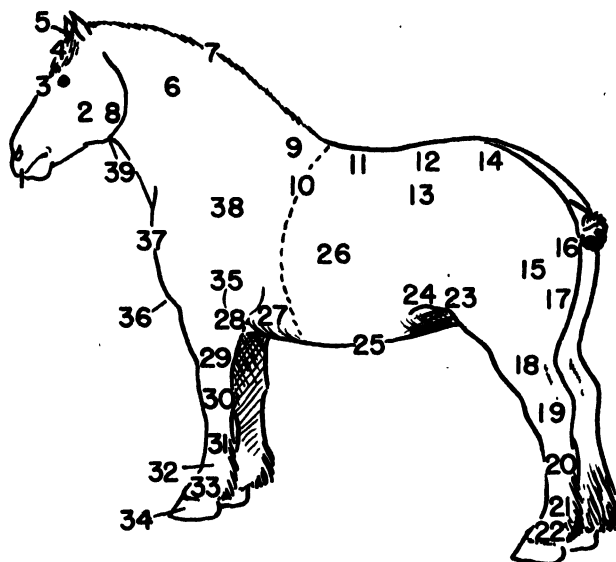


FIG. 256. Parts of the draft horse.

- | | | | |
|-----------------|-------------------------|-------------------|--------------------------|
| 1. Muzzle | 11. Back | 20. Cannon | 30. Knee |
| 2. Cheek | 12. Loin | 21. Fetlock joint | 31. Cannon |
| 3. Face | 13. Coupling | 22. Pastern | 32. Fetlock joint |
| 4. Forehead | 14. Croup | 23. Stifle | 33. Pastern |
| 5. Poll | 15. Thigh | 24. Rear flank | 34. Foot |
| 6. Neck | 16. Point of
buttock | 25. Under line | 35. Arm |
| 7. Crest | 17. Quarters | 26. Ribs | 36. Breast |
| 8. Jaw | 18. Gaskin | 27. Fore flank | 37. Point of
shoulder |
| 9. Withers | 19. Hock | 28. Elbow | 38. Shoulder |
| 10. Heart girth | | 29. Forearm | 39. Throat latch |

performance a knowledge of useful features is of value in selecting draft horses.

1. Age

GENERAL APPEARANCE — 15

- Height: estimated hands (1 hand = 4 inches).
- Weight: one year, 950; two years, 1300; three years, 1500; four years, 1700; five years, 1800 or over.
- Form: broad, deep, massive, close coupled, symmetrical, stylish.
- Quality: refined; bone and joints clean, yet indicating sufficient substance; tendons sharply defined, hair fine, head refined.
- Temperament: energetic, disposition good.

HEAD AND NECK — 7

- Head: proportionate size, well-defined features, straight face line, broad, full forehead.
- Muzzle: broad, nostrils large, lips thin, even.

- 9. Eyes: prominent, large, bright, clear.
- 10. Ears: medium size, fine, well set, carried alertly.
- 11. Neck: long, muscular but not thick, well arched, throat clean.

FORE QUARTERS — 24

- 12. Shoulders: long, sloping (45 degrees), muscular, well laid in.
- 13. Arms: short, muscular.
- 14. Forearms: muscular, wide, tapering to the knee.
- 15. Knees: wide, deep, strong, clean cut.
- 16. Cannons: short, broad, flat, clean, tendons well defined.
- 17. Fetlocks: wide, clean, well defined.
- 18. Pasterns: long, sloping (45 degrees), strong and clean cut.
- 19. Feet: large, round, even size, straight, smooth dense horn, hoof-heads large, round, open; slope of wall parallel to slope of pastern; heels wide, full, one-third height of toe.
- 20. Legs: viewed in front, a perpendicular line from the point of the shoulder should divide the leg and foot in the center; viewed from the side, a perpendicular line dropped from the center of the forearm should fall upon the center of the knee and fetlock joints and meet the ground back of the heel.

BODY — 12

- 21. Withers: high and well defined.
- 22. Chest: deep, wide, full, large girth.
- 23. Ribs: long, well sprung, close.
- 24. Back: short, strong, broad, heavily muscled.
- 25. Coupling (loin): wide, strong, short, heavily muscled.
- 26. Under line: long, straight, flanks low.

HIND QUARTERS — 32

- 27. Hips: wide, level, muscular.
- 28. Croup: long, wide, muscular.
- 29. Tail: attached high, well carried.
- 30. Thighs: deep, wide, muscular.
- 31. Gaskins: wide, muscular.
- 32. Hocks: correctly set, wide, deep, clean cut, well supported.
- 33. Cannons: short, broad, flat, tendons well defined.
- 34. Fetlocks: wide, clean, well defined.
- 35. Pasterns: long, sloping (50 degrees), strong, clean cut.
- 36. Feet: large, even size, straight; smooth dense horn, hoof-heads large, open; heel wide, one-half height of toe.
- 37. Legs: viewed from the rear, a perpendicular line from the point of the buttock should divide the cannon and foot; viewed from the side, this same line should touch the rear edge of the cannon from hock to fetlock, and meet the ground some little distance back of the heel.

ACTION — 10

- 38. Walk: long straight stride, powerful, regular, snappy, easy, free from rolling.
- 39. Trot: free, straight, long bold stride, regular, hocks close, free flexion of joints.

SCORE CARD POINTS

The major divisions of the score cards are much the same as those for other livestock, general appearance, head and neck, fore quarters, body, hind quarters, and in addition, action.

Age is estimated in scoring of horse. Examination of the teeth will give a basis for age estimates as indicated upon page

653. Age in horses is of importance for two reasons: first, in relation to size for age, and second, in relation to probable periods of usefulness. In horse judging the first reason is emphasized; that is, age and weight are estimated for the purpose of considering weight for age. Probable period of usefulness is not considered in horse judging because type is



FIG. 257. A draft gelding of the right type, Sir James, an imported Clydesdale, grand champion gelding at the International Livestock Exposition. (Anheuser-Busch, Inc., St. Louis, Mo.)

stressed, which refers to usefulness for a purpose. The age is a factor in horse prices and in the buying of horses, as is shown in the chapter on horse marketing.

I. GENERAL APPEARANCE. The divisions of general appearance are height, weight, form, quality, and temperament.

Height is another estimate in appraising the worth and usefulness of a draft horse. The height is the distance from the ground to the top of the withers. It is given in hands (4 inches). A horse 16 hands $2\frac{1}{2}$ inches high is 66 $\frac{1}{2}$ inches tall. The

mature draft horse will range from 15 hands, 2 inches to 17 hands in height.

Weight is also estimated. A standard of weights for age based upon the usual weight increase of well-bred and fed draft type individuals is as follows:

<i>Age, Years</i>	<i>Weight, Pounds</i>
1	950
2	1300
3	1500
4	1700
5	1800

These may be regarded as minimum weights for acceptable individuals. Draft horses with mature weight of 1800 to 2000 pounds are the most desirable on the market. Stallions are heavier than mares at comparable ages. With good representatives of the common draft breeds the stallion will weigh 2000 pounds or more and the mares 1800 pounds or over. Farm horses weighing 1600 pounds are desirable in most localities. Weight is essential for adhesion to the ground, thereby overcoming the tendency to slip. Weight in the drafter offsets the weight of the load. Also, heavier horses are generally more muscular than lighter horses. A correlation between body weight and tractive pull of 0.6 has been shown in dynamometer tests.¹ Weight coupled with muscular development and adequate skeletal structure is desired, rather than accumulation of adipose tissue. Since the outlet for heavy draft horses for heavy hauling in cities and for construction work has been nearly closed, and on farms tractors replace horses for the heavier work, the large-size draft horse is less popular. The medium-size light draft horse is suitable for most kinds of draft work.

The *form* of the approved drafter is wide, deep, massive, compact or closely coupled, balanced or symmetrical, and stylish. Draftiness is synonymous with massiveness and muscularity. Likewise the drafter should have a rugged appearance. Insufficient muscling with narrow, shallow, rangy bodies is still too common in draft horses.

¹ Ralph W. Phillips, Milton A. Madsen, and Harry H. Smith, "Dynamometer Tests of Draft Horses," Utah State College, *Circ.* 114, November 1940.

The good draft horse is neither low set nor rangy, as a moderate length of leg is desired. Low-set horses have a low center of gravity, but they are usually poor movers. Rangy, upstanding drafters are not in demand. Long-legged horses are slow maturing, and when grown out they are too large for general adaptability. Such horses may be awkward and

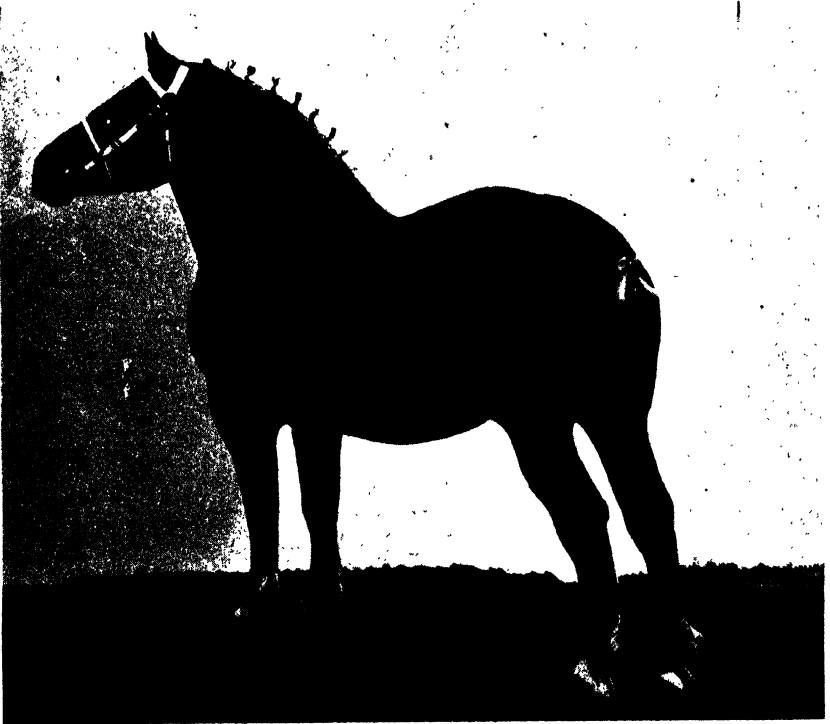


FIG. 258. A draft mare of outstanding merit. A purebred Belgian mare, Flora, grand champion at the American Royal. Owned by Oklahoma A & M College, Stillwater, Okla.

cumbersome; also, the food requirement is high. Such conformation is commonly associated with "hard feeding." In none of our farm animals is balance and style so important as in horses. An active, stylish, yet manageable horse, with good carriage, is in demand for a draft horse.

The *quality* of a draft horse is indicated by refinement of the various parts, rather than coarseness. The bones, joints, and the head indicate the quality. A general clean-cut appearance

of the legs and the head is desired. Ruggedness and massiveness are prerequisites, and in a measure they are antagonistic to refinement. It is apparent that we want ample bone in our ideal. It can be too fine or too coarse. Clean joints such as the hocks, fetlocks, pasterns, and knees are evidence of good quality, while thickness, or meatiness of the joints, is objectionable.

The temperament of a draft horse should be active and energetic, rather than too lymphatic. However, tractability with a good disposition are essential qualities. A draft horse needs to be steady and dependable in work. Also, it should be willing to work, with ample animation.

2. HEAD AND NECK. The head and neck of the draft horse should be in proportion to the rest of the individual. The head indicates the temperament, intelligence, activity, vigor, and breeding of the horse. A clean-cut, well-defined *head* indicating character is desired. Width and a full forehead are wanted, and the width should carry down to the *muzzle*. Such width of muzzle and also body width and depth are typical of a good feeder. Large nostrils and thin and even lips are suggested in the ideal head. The jaws should be very wide at the angle underneath and also show a moderate depth. Vision is one of the essentials of a useful draft horse. Therefore, *eyes* that are normal in size and appearance are preferred. A full, bright, clear eye describes the ideal. The *ears* of a good head are of medium size, fine quality, well set, and erectly carried.

The head of the stallion indicates his masculinity, while a feminine or matronly appearance is characteristic of the brood mare.

Since draft horses are commonly worked in harness with a collar, a medium length of *neck* is needed to facilitate the fitting of this important part of the work harness. Muscularity, a medium development of the crest, and good carriage are desirable qualities in the neck of a good draft horse. Likewise, the neck should be neatly joined with the head and the shoulder. An attractive appearance demands a well-carried head and neck. It is one of the most important components of style.

3. FORE QUARTERS OR FOREHAND. In weight or total score the parts included in the fore quarter are exceeded only by the hind quarter. As the fore limbs are a part of the fore quarters

they carry considerable weight. In fact, most of the emphasis on this division is given to the front legs.

Shoulders are important as this structure affords a bearing surface for the collar. Well laid in shoulders that are muscular, long, and sloping are prescribed in the ideal. A straight shoulder is often associated with faulty action and improper carriage of the head and neck. Further, it is difficult to fit a straight shoulder properly with a collar. The *arm* and *forearm* that are heavily muscled and rather wide and short are needed in the efficient draft horse. The forearm should taper gradually to the knee.

On some score cards the feet and legs are a major division; in other discussions the legs and feet are considered with the part to which they are attached. Therefore, we have the fore legs discussed with the fore quarter, and the hind legs included with the hind quarters. This should not minimize emphasis on feet and legs. The usefulness of a horse is dependent upon the underpinning. Since so much stress is placed on the feet and legs, the consideration of the parts of the feet and legs becomes doubly important.

The *knees* on a draft horse should be reasonably large, wide, deep, strong, and clean cut. The ideal set of the fore leg is dependent upon the set of the knees. They should not "buck" forward or be set too far back. Straight legs are essential for straightaway action and durability.

Desirable *cannons* are short, broad, flat in appearance, clean cut, and with tendons well defined. A cannon ample in size, strong, and rugged, yet which shows quality, is a requirement for a good draft horse. Hard, smooth bone, adequate in size, is essential for endurance and durability. With tendons well back from the cannon bone, the cannon has a desirable flat appearance. As is true with the other joints of the limbs the *fetlocks* should be shapely, clean cut, well defined, and free from excess thickness. In horseman terms, a joint unduly large or not clean cut is "meaty."

Pasterns serve as a shock-absorbing mechanism. Reasonable length and a slope at an angle of 45 degrees are suggested for this part. Likewise, they should be clean and ample in size.

A good foot is imperative for any serviceable horse. It has

been found that feet that are large, round, shapely, of dense horn, and wide at the heels are durable. The forefeet should be uniform in shape and size. Size is a necessity, because upon it depends the amount of bearing surface. Depth is also a requirement of a good foot. The heels should have moderate depth as well as sufficient width. The wall slopes out moderately or flares from the hoof head which should be large, round, and open, conforming to the size of the hoof. Durability or toughness of the roof is indicated by a dense, hard horn.

The legs are viewed from both the side and the front to observe their set. Straight, well-set legs are needed for good action and long service. The proper set of legs is shown in illustrations on page 648, which also depicts common defects.

4. BODY. The *withers* of a horse should be fairly high and well defined. Depth and width of the middle are desired qualities, and we stress especially a well-developed full chest with ample girth; also a roomy middle with long, well-sprung *ribs*.

Along the top we look for a *back* and *coupling*, or loin, that is short, strong, broad, and well muscled. A long, fairly straight under line with low flanks completes the description of the body.

Shallow bodies or light middles are not wanted in drafters.

5. HIND QUARTER. Since the hind quarter includes the hind leg, this division receives more emphasis than any of the others. Heavy muscling is an essential in the hind quarters of the approved draft type, but more important is a satisfactory conformation of the hind leg. The hind leg must bear the strain of the power in moving loads from the heavy muscles in the hind quarters.



FIG. 259. Well-set front legs. The front legs are vulnerable parts of the draft horse.

The *hips* are required to be wide, level, smooth, and muscular, as is also the *croup*. Reasonable length is demanded in the croup, and a drooping croup is objectionable. A short, sloping croup is often associated with crooked hind legs. A well-carried *tail* attached fairly high is also desired. Width, thickness, and muscularity should characterize the *thighs* and the *lower thigh* or *gaskin*.

The *hock* joint is the most important single joint in the body of the horse. The muscles in lever fashion flex and then extend the leg at the hock joint and by so doing the horse is moved forward. So the load is moved and the force is transmitted through the one joint, the *hock*. In an ideal hock we want size, rugged, ample, bearing surface, and correct setting. The latter is most important since hocks that are out of line or crooked are unable to withstand the strain of hard work. Likewise, the hock must be clean cut, that is, free from enlargements of any kind which so generally indicate weakness or unsoundness.

Below the hock are the cannons which, like those in the front leg, should be short, wide, flat, with well-defined tendons set well back from the cannon bone. Fetlocks, pasterns, and feet such as described for the fore leg are desired in the hind leg with the exception that less slope of pastern is acceptable behind. The hind feet are usually smaller and generally have less difference between the depth of the toe and the heel than the front foot.

The set of the hind leg is viewed from both the side and the rear and lined up with other features of conformation. Proper set is essential for durability and good action. The ideal set of the hind leg and common deviations are discussed and illustrated on pages 648 and 649.

6. ACTION. The action of the draft horse is observed at both the walk and the trot. Draft horses do not work at a trot and the only reason for trotting such horses is that it may accentuate faults in action. At either the walk or the trot the feet should move straight ahead in the direction of travel. A walk that is powerful, regular, snappy, elastic, with a long stride is desired. A light springy step with animation marks a good walk. The trot should have the same characteristics plus close carriage of the hock and free flexion of all the joints.

Lameness is a serious defect of action and usually just cause for disqualification.

Judging Horses

In judging classes of horses the first step is to make an observation at some distance away. Orderly examination is advisable as there are many items to consider in appraising the value of a horse. In this initial observation if a group is being judged it is advisable to walk around the class to size up the lot as a whole. Individual examination should follow to consider the general appearance. In this the horse is studied from the sides and the ends. Then at closer inspection a more detailed study should be made of the feet and legs. The mouth is also examined to estimate the age. Likewise, the height at withers is to be noted.

Unsoundnesses are considered in placing horses and mules. Because of their importance they are discussed separately in Chapter 42.

After a rather detailed examination of each individual, the class is "moved" to observe the action. The horses are moved as the walk is demonstrated and then the trot. The observed horse moves away and towards the judge. In other words, action is observed from the front and the rear rather than the side. In noting the action the straightness, length, flexion, power, springiness, and balance are to be considered. Lameness, too, must be watched for. Finally, in placing a class a final general observation is made.

Set of the Legs

Much attention is generally given to the set of the legs on a draft horse. (See Figures 260, 261, 262, and 263.) The score card description is for the fore leg: viewed from the front, a perpendicular line from the point of the shoulder should divide the leg and foot in the center; viewed from the side, a perpendicular line dropped from the center of the forearm should fall upon the center of the knee and fetlock joints and meet the ground back of the heel.

For the hind leg: viewed from the rear, a perpendicular line from the point of the buttock should divide the cannon and

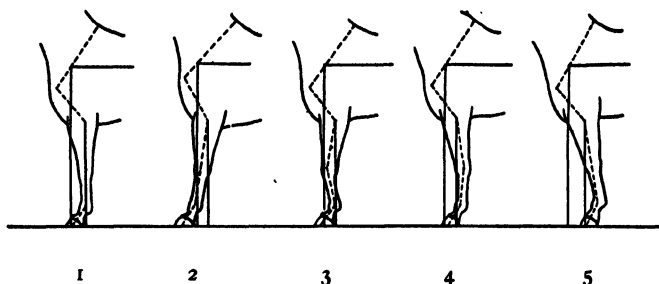


FIG. 260. Side view of fore legs. A perpendicular line dropped from the center of the forearm should fall upon the center of the knee and fetlock joints and meet the ground back of the heel. 1. Correct conformation. 2. Leg too far forward. 3. Knee sprung. 4. Calf kneed. 5. Foot and leg placed too far back.

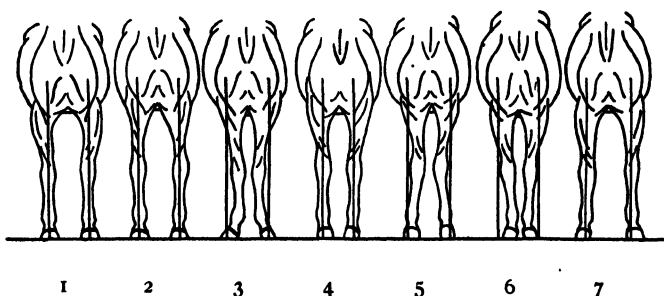


FIG. 261. Front view of fore legs. A perpendicular line from the point of the shoulder should divide the leg and foot in the center. 1. Correct conformation. 2. Slightly bowlegged. 3. Close at knees. 4. Toes in. 5. Knock-kneed. 6. Base narrow. 7. Base wide.

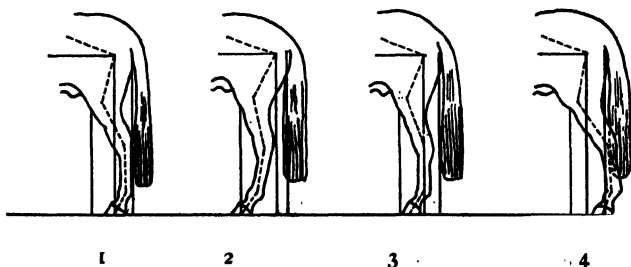


FIG. 262. Side view of hind legs. A perpendicular line should touch the rear edge of the cannon from hock to fetlock, and meet the ground some little distance back of the heel. 1. Correct conformation. 2. Leg too far forward and hock crooked. 3. Entire leg too far under and weak below hock. 4. Entire leg placed too far backward.

foot; viewed from the side, this same line should touch the rear edge of the cannon from hock to fetlock, and meet the ground some little distance back of the heel.

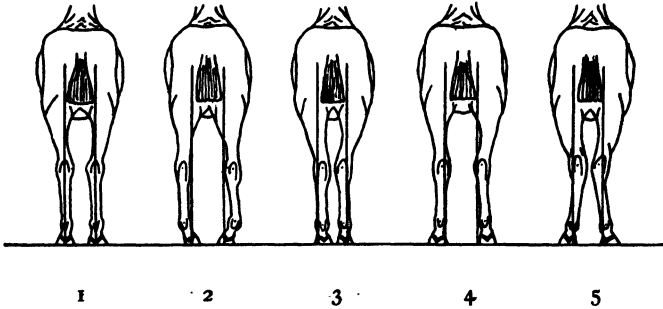


FIG. 263. Rear view of hind legs. A perpendicular line from the point of the buttock should divide the cannon and foot. 1. Correct conformation. 2. Bow legged. 3. Base narrow. 4. Base wide. 5. Cow-hocked and toes out—a very serious fault.

One of the most serious of the defects in the set of the legs is the faulty conformation of the hocks known as “sickled” or bent hock. Horses at hard work tend to wear out at the hock joints and the front legs. Proper conformation of each will give long wearing qualities. A sickle hock is identified from a side view by noting the relationship of the parts that join at the hock. If the line dropped from the point of the buttock does not fall parallel with the rear of the cannon the hock is sickled. The position of the hind leg may make it difficult to determine whether or not the hock is set right. It is possible to have the cannon vertical and still have a sickled hock. In such cases the leg is too straight and set under the body or it may be set back. Figure 264 shows a typical sickle hock.



FIG. 264. A crooked or sickled hock. Note that a perpendicular line cannot fall parallel with the rear of the cannon.

In the set of the leg and the foot a proper relationship be-

tween the two is highly desirable. This is indicated in part by the axis of the foot and leg. This relationship is affected by wear of the foot, as that may alter the slope of the pastern. With the toe part grown out too long the pastern is forced back out of its natural line. When the toe is short, the pastern is thrown forward. It is apparent that an extreme in either direction causes strain and may cause an unsoundness. Proper care of the feet will prevent such a condition. Trimming the feet is a part of good horse husbandry.



FIG. 265. The right kind front foot. Note the shape and symmetry. From the noted Belgian mare, Prevenche. (Michigan State College.)

Action of the Horse Described

In movement of the horse the weight of the body is moved forward and the legs in turn support the weight and propel the body. As the weight of the body is moved forward the front legs support more of the weight and the hind legs propel the body. At the end of a stride or the advancing movement the foot touches the ground ahead of its natural position when standing. Then as the body is moved forward the legs act as a support and also a member through

which a propelling force is exerted. When the foot is lifted from the ground in movement there is flexion of the limb followed by forward extension and contact with the ground to regain the equilibrium.

The manner of moving or way of going may be one of several kinds. A draft horse may walk or trot. The walk is the working gait of the draft horse and it is a slow, flat-footed, four-beat gait. The trot is a rapid two-beat gait in which there is a coordinated movement of the front legs with the opposite

hind legs. In other words, the right front and the left hind move forward together. The other gaits and their distinctive characteristics are included in the chapter on light horses.

Defects in Action

Good action is characterized by a true or straight moving, a long stride and reasonable flexion. Essential for good action are feet and legs of the right conformation, combined with correct balance of the parts of the horse. It is impossible for a horse to have true action if the legs are incorrectly set or if the feet are misshapen.

Gay¹ has given the following defects or peculiarities in the way of going of horses:

Forging. Striking the ends of the branches or the under surface of the fore foot shoe with the toe of the hind foot.

Interfering. Striking the supporting leg at the fetlock with the foot of the striding leg. It is predisposed in horses with base narrow, toe wide, or splay-foot standing position.

Paddling. An outward deviation in the direction of the stride of the fore leg, the result of a toe narrow or pigeon-toed standing position.

Winging. Exaggerated paddling, noticeable in high going horses.

Winding. A twisting of the striding leg around in front of the supporting leg in much the same manner as in paddling. This is most commonly seen in wide-fronted draft horses at the walk.



FIG. 266. A good front foot of a horse, bottom view. Note the shape, size, and width at the heel. The shoe fits the hoof and is attached by nails to the fore part of the foot so the expansion at the heel is not interfered with. (Michigan State College.)

¹Carl W. Gay, *Productive Horse Husbandry*, Lippincott, Philadelphia, 1932.

Scalping. Hitting the front of the hind foot above or at the line of the hair against the toe of the breaking-over fore foot.

Speedy Cutting. The spreading trotter at speed hits the hind leg above the scalping mark against the inside of the breaking-over fore foot as he passes.

Cross Firing. Essentially forging in pacers, in which they hit the inside of the near fore and off hind foot or the reverse in the air as the stride of the hind leg is about completed and the stride of the fore leg just begun.



FIG. 267. A draft horse in action at the trot. A good trot is free, straight, and regular. The stride should be long, the joints freely flexed, and the hocks carried close.

Pointing. A stride in which extension is much more marked than flexion. It is especially characteristic of the Thoroughbred. The same term is also used to indicate the resting of one fore foot in an advanced position to relieve the back tendons.

Dwelling. A perceptible pause in the flight of the foot, as though the stride had been completed before the foot had reached the ground. Most noticeable in actors.

Trappy. A quick, high, but comparatively short stride.

Pounding. A heavy contact, usually accompanying a high stride.

Rolling. Excessive lateral shoulder motion as in wide-fronted horses.

Work Stock Desired by Farmers

A survey of farmers in the midwest by the Horse and Mule Association of America indicated that farmers want horses with

a good set of legs, alertness, a fast walk, and ability to endure hard work in warm weather:

The measurements of 243 work horses which suited their owners indicated preference for a work horse of the following dimensions (rounded to nearest whole number); height, 63 inches, actual average 15 hand 3 inches; body length, 40 inches; girth, 80 inches; distance from chest floor to the ground, 33 inches.

*Determination of the Age of Horses and Mules*¹

The ordinary observer can readily learn to tell the age of horses or mules with considerable accuracy until the animals have passed their eighth year. Beyond this time even those who are experienced may find it difficult to determine the exact age.

The mature male horse has 40 teeth. Of these, 24 are molars or grinders, 12 are incisors or front teeth, and 4 are tushes or pointed teeth. The two central incisors are known as centrals or nippers; the next two, one on each side of the nippers, are called "intermediates" or "middles," and the last, or outer pair, the corners. The tushes are located between the incisors and the molars. As these are not usually present in the mare, she may be considered to have a total of 36 teeth rather than 40, as in the male.

The young animal, whether male or female, has 24 temporary teeth, commonly called "milk teeth," as they are much whiter and smaller than the permanent teeth. These milk teeth consist of 12 incisors and 12 molars. The latter are the three back teeth on each side of both the upper and the lower jaw. The milk teeth are shed and replaced by permanent teeth at fairly definite periods, which serve as an index in determining the age of young colts.

The temporary central incisors or nippers may be present at the time of birth; otherwise they appear before the colt is 10 days old.

At the age of from 4 to 6 weeks the two temporary intermediates, upper and lower, appear. These teeth immediately adjoin the nippers.

¹ George W. Pope, "Determining the Age of Farm Animals by Their Teeth," *Farmers' Bull.* 1721, U.S.D.A., March 1934.

When the colt is from 6 to 10 months old the corner or outer incisors, two above and two below, are cut. This gives the young animal a full set of temporary front teeth.

By the time the colt has reached the age of 1 year the crowns of the central incisors show wear. In another 6 months the intermediates or middles become worn, and at 2 years all the teeth are worn. During the following 6 months there are no changes which will distinguish the exact age. At about $2\frac{1}{2}$ years, however, the shedding of the milk teeth begins, and at 3 years the temporary central nippers, two above and two below, are replaced by the permanent central incisors.

At 4 years the four permanent intermediates have taken the place of the four temporary middles.

When the animal is about $4\frac{1}{2}$ years old the shedding of the four corners begins, and at 5 years a permanent set of teeth which replaces them are well up but not in contact.

In a 6-year-old horse the corner incisors are on a level with the adjoining teeth, with a well-marked dental cavity or "cup" showing practically no wear. The nippers show wear over the entire surface; the "cup" though visible shows indications of gradual disappearance and at this stage is without a hollow.

When the animal is 7 years old, not only the nippers but also the middles show wear. With each upper corner tooth there is an indentation caused by wear from the corresponding tooth below it, resulting in a downward triangular projection of the posterior edge. This projection is commonly termed "dove-tail," or "swallow-tail."

In the 8-year-old horse all the incisors are worn. The cup has entirely disappeared from the nippers but shows to a slight extent in the middles and is still well marked in the corners. At this stage what is termed the "dental star" makes its appearance as a yellow transverse line just back of the front edge of the table, or flat surface, of the nippers and middles.

Between the ages of 9 and 13 years there is a gradual change in the contour of the tables of the incisors. In a 9-year-old animal the nippers take on a more or less rounded contour; the dental cavity or cup has disappeared from all but the corners; the dental star is found in both the nippers and middles and in the former is near the center of the table. At 10 years

the middles become rounded, and the dental star, now seen on all the incisors, is near the center of both the nippers and middles. At 11 or 12 years the corners have a somewhat rounded form, and the dental star approaches the center of the table. As the horse reaches 13 years of age all the lower incisors are unmistakably rounded, the dental star is found in the center of all the tables, and the enamel rings which formerly surrounded the cups have entirely disappeared.

In a horse about 14 years of age the tables of the incisor



FIG. 268. An eight-horse draft team in action. (Anheuser-Busch, Inc., St. Louis, Mo.)

begin to change from a rounded to a triangular contour. This change occurs in the nippers at 14 years, in the middles at 15 years, and in the corners at 16 or 17 years.

During the 4 years after the appearance of the triangle, there is a gradual approach of the tables to the form of a rectangle. The teeth during this period are usually elongated and directed obliquely. The dental arch also becomes contracted and pointed and the under edges of the lower jaw are thin and sharp as compared with their appearance in a young horse. Should the animal live more than 20 years, these conditions become more marked and are accompanied by excessive wear and loosening or loss of molars.

Chapter 39

FARM HORSES

Nearly three-fourths of our farms report having horses and/or mules. Yet the place of the horse and the mule has changed vastly in recent decades. The reduction in numbers of work stock has been previously pointed out. The diversion to other crops of land that formerly was used to produce horse and mule feed is regarded as one of the greatest changes in American agriculture. The decline in the demand for feed because of the replacement of horses by agricultural machinery, together with the decline in demand for export, has been partially responsible for low income from farm crops. /

The Effect of the Decrease in Farm Work Animals

It has been estimated that the reduction in horses and mules from 1919 to 1935 has released for other purposes about 35 to 40 million acres that used to grow feed — a diversion that has been a large factor in our agricultural surpluses. The acreage now not in production of work stock feed has resulted in increased production of nearly all other crops. Further pasture in considerable amounts was released for other uses when our work stock declined. Another effect was the reduction of men needed on farms, as a smaller number were needed to do the work. One man could produce more crops.

When horses or mules are used on farms without other motor power, one work horse is needed for about 25 to 30 acres of cultivated land. The average size farm is about 174 acres. Of this approximately one-third or 58 acres is in land used for crops. Therefore, the average size farm would require more than two or three horses or mules to do the farm work. Since there are only about 3.8 head per farm on farms having work stock and many of these are not work stock, it is obvious that much of the farm work is being done by motor power other

than horses and mules. On the basis of the number of work animals (horses and mules) per 1000 acres in farms, we had but 13 head in 1940. In 1910 there were 27 head of horses and mules and there was not much change in that decade as there were 26 in 1920. By 1930 the number had declined to 19 head. It is apparent that in 20 years farmers had replaced about one-half of their horses with trucks, tractors, and automobiles.

The decrease in horses and mules has been accompanied by an increase in the mechanization of agriculture, especially crop raising, harvesting, and hauling. The agricultural areas of greatest reduction in work stock were those with the greatest increase in mechanization.

Increase in Tractors, Motor Trucks, and Automobiles

The increase in numbers of tractors, automobiles, and motor trucks and the decrease in horses and mules over a period of years is shown in the table which follows.

THE NUMBER OF TRACTORS, AUTOMOBILES, MOTOR TRUCKS, HORSES, AND MULES TWO YEARS OLD AND OVER, ON FARMS, AND NUMBER OF FARMS JANUARY 1¹

<i>Year</i>	<i>Tractors, Thousand</i>	<i>Automobiles, Thousand</i>	<i>Motor Trucks, Thousand</i>	<i>Farms, Thousand</i>	<i>Horses and Mules, Thousand</i>
1910	1	50	0	6,362	19,429
1915	25	472	25	—	21,866
1920	246	2,146	139	6,448	22,386
1925	549	3,283	459	6,372	21,038
1930	920	4,135	900	6,289	17,981
1935	1,048	3,642	890	6,812	15,471
1940	1,610	4,185	935	6,096	13,368

The growth in tractor numbers apparently had little effect upon the number of horses and mules until after 1925, although their increase has been continuous. Thirty years ago tractors and motor trucks were comparatively rare on farms, but now we have a tractor to about every 3.8 farms and a motor truck to every 6.5 farms. Motor trucks and automobiles on farms

¹ Data from Census, Bureau of Agricultural Economics, and Agricultural Marketing Service. *The Agricultural Situation*, U.S.D.A., May 1941.

have not increased greatly since 1930. During the depression years of the early '30's, replacements by tractors were at a slower rate than prior to or following that time.

The degree of the replacement of horses and mules on farms by tractors is not the same in different areas. Tractors increased to the greatest extent in the great plains, the corn belt, the Pacific coast, and the Rocky Mountain states. As a source of farm power, tractors are also quite important in the southern part of our country in the area beginning with the states of Louisiana and Arkansas on the west, and south of the Ohio River and the state of Maryland. In the eastern part of the cotton belt and the northwestern dairy states there has been less replacement of horses and mules by automotive power than in any of the principal crop areas.

The reasons for the slower adoption of tractors in the cotton belt are the small size of farms, irregularly shaped fields, and rolling land. Economic reasons also checked a replacement, for with wages and cotton prices relatively low, changes in methods involving investment in additional equipment would be at a minimum. Then too, many of the operations in the growing of cotton such as hoeing and picking are not so adaptable to mechanization. Farms or ranches classified as stock ranches, animal specialty, and cash grain farms have the largest number of horses per farm. General farms, too, usually have quite a lot of work stock. There are horses or mules on nearly 9 out of 10 of our general farms.

Tractors have been modified to be suitable for a wider range of farm work. The all-purpose tractor is the popular one with the American farmer on the average size farm. Further improvement of tractors and mechanized equipment will result in further competition for farm work stock.

Machine methods have been more completely used in the growing of small grains, such as wheat, oats, barley, rye, flax, rice, buckwheat, and small grain mixtures, because of the nature of the planting and harvesting of the crop. Small grain is grown extensively under conditions suitable to the use of tractors. In the production of these crops according to a U. S. Department of Agriculture survey, the percentage of the work done with tractor power is 71 per cent for breaking land,

70 per cent for disking, 57 per cent for harrowing, 48 per cent for drilling, and 69 per cent for harvesting. It will be noted that the heavier work in crop production is being done by tractors.

Motor Trucks and Horses

In the hauling of farm produce to market the motor truck has almost completely replaced animal tractive power. Motor truck transportation has largely taken the place of team hauling where the roads are suitable and long hauls are made. Speed and greater flexibility are in favor of the truck. The summary made in February, 1940 of the methods used to haul small grains to the market, based upon reports from 25,000 crop correspondents,¹ showed that 90 per cent was hauled to market with auto, truck, or tractor.

Horses and Tractors

The most useful basis for comparison of horses and tractors on the farm should be on the return per farm. However, some of the advantages of either as motive power are difficult to appraise. For example, with horses a use is made of considerable unmarketable feed, and, on the other hand, with tractors the farm work may be done with less time or man labor. It is apparent that the economy of either form of tractive power is dependent upon the cost of the horses or mules and feeds as compared with the cost of tractor gasoline, oil, and repairs. Since it is impossible to secure a comparison of net returns from farms operated either way, for the purpose of making a choice the merits and also the shortcomings of each kind of power will be pointed out.

The main advantages from the use of horses in comparison with tractors are:

1. Horses are better adapted to the varied kinds of farm work and they have a decided advantage on smaller farms with small fields. Horses are flexible in regard to the number hitched and also reserve draft power.
2. Horses are suitable for a wider range of farm land, in

¹ *The Agricultural Situation*, B.A.E., U.S.D.A., May 1941.

respect to both the condition in which land can be tilled and topography of land. Farms with rolling rough or wet land may be more easily tilled with horses than tractors, and horses make use of the pasture available.

3. On most farms, especially general farms, some horses are needed. Even though all-purpose tractors have been developed there still are some farming operations that are more efficiently done by horses.

4. If young horses are used they appreciate in value during their working period on the farm and can be sold at the age of highest value.

5. Horses and horse-drawn equipment, because of their lower investment, have less depreciation, and also a lower interest on the investment. Because of this, horses may yield tractive power at a lower cost than tractors.

6. Less mechanical ability is needed in using horses for farm work than with tractors. The kind of labor will determine to some extent the most profitable type of motive power.

7. Horses make use of much material which might be wasted, as forage and pasture, if livestock did not use it.

8. Soil fertility is maintained by feeding the horses as compared with cash grain tractor farming.

9. A given acreage will provide sufficient feed for a horse with average crop yield, but this may or may not be sufficient to purchase the gas, oil, and other essentials for a tractor operation. When agricultural income is low the horse power is also low in cost, since the horse consumes considerable of the output from the farm.

The tractor has the advantage of a high capacity for work. Farm work then can be done more rapidly with tractors, which may at times be highly advantageous. Where a combination of power is available a peak load period can be more effectively handled by tractors. A farmer's capacity for work is thereby increased, and if this is used properly it may mean a higher net income per farm, even though his cost per unit of work done may be higher. A tractor can also be used as a source of belt power for grinding feed and such uses and also for operating power take off equipment on movable units. At one time work stock

were used for belt power by means of horse power equipment, but such equipment has nearly passed out of existence. Tractors can be used for more hours per day than horses and are not hampered by such things as heat, flies, etc.

In deciding the type of power suitable for a particular farm, all of the factors in the situation are to be considered. Almost every farm is a problem in itself, and a solution suitable for all is impossible. If a combination of horses and a tractor is the solution, one should supplement the other rather than have an excess of each. The best possible combination should be worked out to meet the need, and a suitable combination for one farm would not necessarily fit another farm. In planning the operation of a farm the manager, to be successful, should use efficiently the available farm power, whether it be horses, tractors, or both.

Tractors and Farm Size

Farms have been increased in size. In 1910 the average farm was 138.1 acres. Since that time the increase has been gradual to the current size of about 174 acres. Small farms are more economically operated by work stock than tractors. The farm should have in excess of 75 cultivated acres before the horses and mules are replaced by a tractor. It has been found that to be economical a tractor should replace at least three work horses unless belt work or custom work is a factor. It has been observed that on farms where tractors are purchased more land is tilled and more land is acquired. A number of farmers operate noncontiguous tracts when a tractor and tractor equipment is purchased. A suggested ratio of replacement is that 1 tractor is equivalent to 5.5 horses and 1 truck equivalent to 2 horses.¹ The improvement of small tractors has markedly changed the situation with regard to the work stock replaced per tractor.

Using Horses Efficiently

In order to have efficiency in the use of horses or to reduce the cost of horse labor to a minimum it is necessary to:

1. Use effective combinations or hitches. These are described in the paragraphs that follow:

¹ *The Farm Horse*, U. S. Dept. of Commerce, Bureau of Census, 1933.

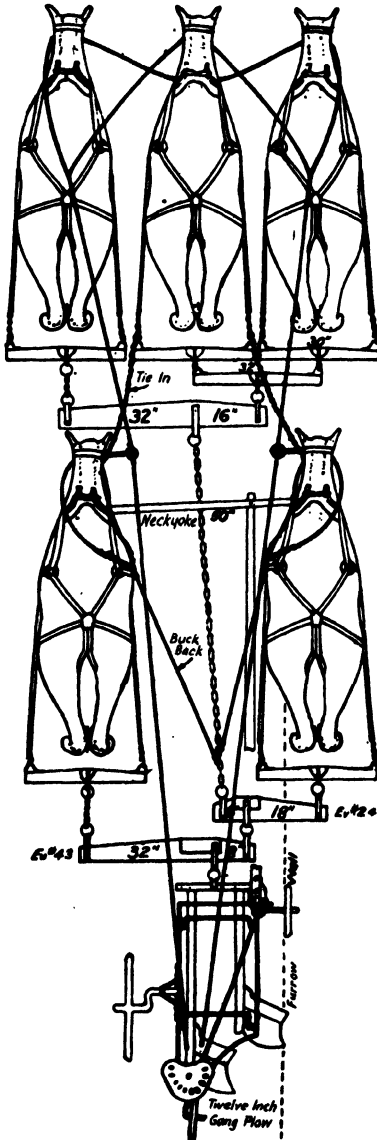


FIG. 269. Details of a five-horse hitch. Note the "tie-in chains" and "buck-back" straps, also the arrangement of the eveners. (Horse Association of America.)

2. Feed economically on ample but not excessive ration.

3. Use efficient horse-drawn farm equipment.

4. Raise some colts and use the young horses for the farm work.

Horse power costs are high when more horses are kept than are needed and they are not used efficiently. Also, when feed costs are high horse labor is expensive.

If horses are fed on farm-raised feeds, farm power costs are kept comparatively low. Less threshing of the feed crop is suggested as another means of reducing costs—that is, feeding such feeds as sheaf oats. Likewise, extensive use of pasture will cheapen as well as improve the ration. It has been found that nearly three-quarters of the cost of horse labor is for the feed.

Multi-Hitches for Horses

The use of multi-hitches has made for greater adaptability in the use of horses and mules. The principles of the multi- or big hitches were developed for farmers in the wheat growing areas of the northwest. In that section such hitches were used for the grain combines. The Horse Association of America introduced these hitches to

other parts of the United States where they have been found effective for utilizing teams of four or more horses.

There are two essential features of this hitch method: (1) the eveners are adjusted so that the draft on all members in the team is equalized, and (2) a system of "bucking back" and



FIG. 270. A big hitch or multi-hitch in operation.

"tying in" is used so that each individual is held in its proper place and the entire team can be handled by two lines. The use of this method of hitching makes for ease in handling the team, and effective use of the team since each individual's draft is equalized and side draft is largely eliminated. Crowding in working teams with its consequent ill effects is largely elimi-

nated by the multi-hitches. A typical multi-hitch for five horses is shown in Figure 269.¹

Feed Required per Work Animal per Year and the Land Required to Produce It

The estimated amount of feed required per animal per year,² when fed a standard ration, would be 145.5 bushels of oats or

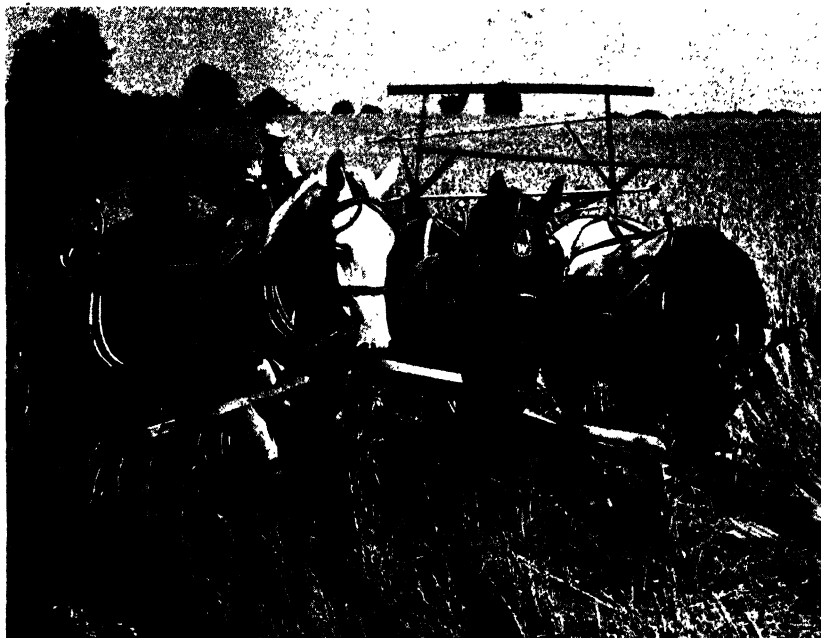


FIG. 271. A four-abreast hitch. Percherons in the harness on a midwestern farm.

71.7 bushels of corn or 83.6 bushels of barley and 2.2 tons of hay. The standard ration is a ration suitable for light work, and is about twice an economic maintenance ration. Consideration of average yields for a ten-year period shows that an average horse would require 1.7 acres of hay and 4.2 acres of oats or 2.5 acres of corn or 3.7 acres of barley.

¹ Literature descriptive of these big-team hitches is available from the Horse Association of America, Wayne Dinsmore, Secretary, Chicago, Illinois.

² *The Farm Horse*, U. S. Dept. of Commerce, Bureau of the Census, 1933.

Ratio of Colts¹ to All Horses and Mules on Farms

The number of colts now being raised is less than it was formerly. The tabulated data which follows shows how the colt crop has decreased by decades. The data are from the census reports; consequently the colts reported are for the year previous to the data of the census.

COLTS TO 100 HORSES AND MULES

<i>Year</i>	<i>Ratio of Colts to All Horses in United States</i>	<i>Ratio of Horse and Mule Colts to All Horses and Mules in United States</i>
1900	7.20	7.18
1910	8.73	8.51
1920	6.06	6.30
1930	3.66	3.05
1940	3.98	3.23



FIG. 272. A grand champion quarter horse. Saddle horses are very useful on the ranch and farm. Owned by Bob Denhardt, College Station, Texas.

The ratio in the first column is between colts and all horses while in the second it is between horse and mule colts raised

¹ Among horsemen the term "colt" is restricted to male foals to distinguish them from female foals, which are called fillies. In census reports those colts include both the males and females to distinguish them from mule colts.

and the total horses and mules. Between the 1910 and 1920 censuses the rate of replacement became insufficient to maintain the population. In fact, the peak in horse breeding in this country was in 1910.

The reproduction rate is relatively high in the mountain states. In 1930 it was 6.93 colts for 100 head of horses. The New England states have a low reproductive rate, there being but 0.64 colts raised for each 100 horse population. Thus we have the mountain states as a leading surplus area while New England is a decidedly deficient area.

With a reduction in reproduction the average age becomes older. The average age at 1930 was 9.52 years for horses and mules in the United States. It is obvious that with an increase in average age the value and usefulness is decreased. Also, the rate of mortality increases.

Light Horses on the Farm

The family buggy horse has been almost entirely displaced by the automobile. However, the saddle horse on the farm and ranch still performs very essential services. Likewise, it serves as a pleasure animal for riding. Light horses are particularly useful on the ranch and the farm in hilly and mountainous sections.

Chapter 40

LIGHT HORSES

- A horse not sufficiently large to be called a draft horse or a chunk, and too large to class as a pony, is termed a "light horse." Since there is a considerable range in size and usefulness there are several groups of light horses. Light horses include, for example, saddle horses suitable for hunters and Hackneys, which perform as carriage or heavy harness horses. As previously pointed out, we have several breeds of such horses, even more than for the draft type. In aggregate numbers the light horses are much less important than draft horses. In the last census enumeration which listed registered purebreds, there were more than seven times as many of the draft type as of the light horses.

The automobile and truck replaced a great proportion of the light horses which formerly found service as buggy or delivery horses. However, the automobile has not detracted from several of the kinds of light horses, particularly those which might be classed as pleasure horses. In fact, if anything, the motor car has extended the use of pleasure horses since it has made their use available to a greater number. The automobile in many respects represents an addition to the American life rather than a substitution for other forms of transportation. In regions where good roads are unavailable horse transportation is still in use. Likewise, on trails and rough land, horses are indispensable.

The light horse has three principal uses: (1) riding, (2) driving, and (3) racing. It is obvious that some may serve in more than one of these capacities. These for the most part are mainly for pleasure, yet there are many economic uses, as will be pointed out later.

A discussion of the various groups of light horses follows. This separation into groups is on the basis of usefulness, and

also in some cases breed, since some breeds represent fields of service. There is in light horses some confusion as to groups, whether they are a definite breed or merely a group suited for a definite use. In order to be classed as a breed, a common origin, distinguishing characters, and ability to transmit these characters are prerequisites.

The riding or saddle horses are (a) running horses, (b) the three and five gaited horses, (c) hunters and polo ponies, (d) other saddle horses, and (e) other light horses.

The running horse or the Thoroughbred.¹ Such horses might be classed as racing, since this group is used for that purpose.

The running horse or the Thoroughbred was developed in Great Britain for the primary purpose of racing under the saddle. The Thoroughbred came from the improved light horses of England which owed much of their stamina, endurance, speed, and symmetry to the imported stock of Arabian, Barb, and Turkish blood. The native light horses were judged on the basis of their turf or track performance, as racing under the saddle was reported as early as the last half of the twelfth century. Later imported horses contributed to the improvement. From Great Britain the Thoroughbred has been taken to all parts of the world.

Of all the breeds enumerated separately in the 1920 and 1930 census, the Thoroughbred was the only one which increased in numbers of registered purebreds. All other horse breeds declined. There are many other light breeds. In addition to running horses, the Thoroughbred provides us with many saddle horses, hunters, and polo ponies. Straight bred or crossed Thoroughbreds produce good army horses for officers and cavalry mounts. They are also useful in crossing with other breeds for the quality and temperament transmitted to the crosses.

Description of the Thoroughbred

The common colors of the Thoroughbred are bays, brown, and chestnut, with white in varying degrees on the legs and the face. Blacks, duns, and roans also occur.

¹ The term "Thoroughbred" is used for a breed of horses. It is also used as an adjective to designate breeding. However, horsemen regard such usage as incorrect, and among them it is not synonymous with purebred.

The Standard Horse colors from the color guide specified for Thoroughbred horses follow.

STANDARD HORSE COLORS FROM THE COLOR GUIDE
SPECIFIED FOR THOROUGHBRED HORSES
BY THE AMERICAN JOCKEY CLUB

BAY. This varies from a light yellowish tan (light bay) to a dark rich shade, almost brown, and between these a bright mahogany (blood bay).

BROWN. This is sometimes difficult to tell from black or dark bay but can be distinguished by noting the fine tan or brown hairs on the muzzle or flanks.

BLACK. If distinguishing between dark brown and black, the black can be determined by noting the fine black hair on the muzzle.

CHESTNUT. This varies from a dark liver color to a light washy yellow (light or golden chestnut is sometimes said to be sorrel), between which come the brilliant red-gold and copper shades. Never have black mane, tail, or points.

DUN. This varies from mouse color to a golden dun, and very generally is accompanied with black points and stripe.

GRAY. This is a mixture of white hairs and black, sometimes scarcely distinguished from black at birth, getting lighter with age.

ROANS. There are two classes of these — red or strawberry, produced by the intermingling of red, white, and yellow hairs, and blue, produced by intermingling of black, white, and yellow hairs.

The weight of the mature Thoroughbred is about 1000 pounds and the height is about 16 hands. There is considerable range in weight and height.

The form of the Thoroughbred exemplifies development for speed to a very high degree, since they have been bred mainly for racing. In general appearance they are upstanding and rather angular. A small, well-proportioned head with clean-cut features and a straight face line is typical. The shoulders are sloping and muscular. The withers are quite high and distinct. The thighs and the quarter are very muscular and rather angular. In general, the legs are quite fine in bone, clean, and well set, while the feet are rather small. Compared with horses that race at the trot or the pace, running horses have greater development of the fore quarter, a shorter back, and are usually more level at the croup. They also have

straighter hind legs and are relatively long from the back to the ground. The walk or trot is rather low and pointed, that is, one in which extension is much more pronounced than flexion. At the run or gallop the action of the Thoroughbred is at its best. They are quick on the getaway and have a long stride, with



FIG. 273. Thoroughbreds in action. The entries making the first turn in the 67th Kentucky Derby, at Churchill Downs. The winner Whirlaway with a new Derby record of 2:01.2. (Acme.)

very little waste motion. As a group they are active and energetic in temperament. Some individuals are highly nervous and erratic.

Three and Five Gaited Saddle Horses¹

Saddle horses were a necessity in frontier days, and consequently, to meet the need, there was developed a breed called the American Saddle Horse. The states of Kentucky, Tennessee, Virginia, and West Virginia were the first to develop such a type of horse, which was unique to this country. This

¹ A combination horse is one that is shown in harness appropriately hitched and in the three gaited saddle class.

breed was instigated in Colonial days in response to a need for an easy riding horse suitable for travel over poor roads and trails. Later, Missouri came to the front as a saddle horse producing state, and many noted saddle horses were raised in that state.

With the availability of other modes of transportation



FIG. 274. A five gaited saddle horse of the approved type. Note the full mane and tail. The gaits required are the walk, trot, canter, rack, and one of the slow gaits.

there was less need for the saddle horse in his original field. Although such horses were replaced in making long journeys, their usefulness for transportation over rough, semimountainous ground still remains unchallenged. Furthermore, saddle horses are serviceable to ride over plantations. Likewise, stockmen, ranchers, rangers, farmers, livestock buyers and sellers at large markets, mounted police, and army cavalry continue to

use saddle horses extensively. The demand for saddle horses as pleasure horses continues unabated. This demand arises from the growing interest in saddle horses around and about the large cities where riding for recreation has been made available to large numbers.

THE FIVE GAITED SADDLE HORSE

Five gaited saddle horses are derived principally from the American Saddle Horse breed. In fact, the chief distinguishing characteristics of this breed are the so-called "easy" gaits — the rack and the slow gait in addition to the walk, trot and canter. The slow gait may be either the running walk, the foxtrot, or the slow pace. Horses of this type have been bred extensively in Kentucky and Missouri. They are widely distributed in the United States and are popular in and around the large cities where a horse is used for pleasure and recreation. The gaits, or various way of going, are described by Gay¹ as follows.

Walk is a slow, flat-footed, four-beat gait; one of the most useful, whether in harness or under saddle, if executed with snap and animation, as it should be.

Trot is a rapid, two-beat gait, in which the diagonal fore and hind legs act together. The fast stepping trot is characterized by the length and rapidity with which the individual strides are accomplished, and is executed with an extreme degree of extension. The high stepping trot is characterized by the height and spring of the stride, the horse placing himself, going collectedly, and executing each step with an extreme degree of flexion and the utmost precision.

Canter is a restrained gallop in which the weight is sustained chiefly by the hind quarters, the lightened forehand rising and falling in a high, bounding fashion, the gait being executed in a slow, collected, rhythmical way, on either lead at command. Since the canter, like the gallop, imposes a special wear on the leading fore foot and its diagonal hind, the lead should be changed frequently. When the simultaneous beat is of a lateral instead of a diagonal pair of feet, and falls between the successive beats of the other lateral pair, the leading fore and hind

¹ Carl W. Gay, *Productive Horse Husbandry*. Lippincott, Philadelphia, 1932.

on the same side, it constitutes a cross or *lateral canter*, and is productive of a twisting motion to one in the saddle.

Rack is a fast, flashy, four-beat gait, more clearly defined by the discarded name "single foot." It is rarely executed volun-



FIG. 275. A five gaited saddle mare, *America Beautiful*, noted show ring winner. Owned by Red Top Farm, Libertyville, Ill. Mr. James Connors up.

tarily but under compulsion of hand and heel. It is characterized by quite a display of knee action, and many horses can rack very fast. While agreeable to the rider, it is most distressing to the horse, and should therefore be called for with discretion.

Pace is a rapid, two-beat gait, in which the lateral fore and hind legs act together. It is characterized by the readiness with which pacers can get away at speed, a minimum of concussion, more or less side motion, the absence of much knee fold (although some pacers are trappy), and the necessity for smooth, hard footing and easy draft for its execution. It is difficult for most pacers to go in deep or heavy footing, such as fresh snow, sand, or mud, and they have a jerky, unsteady way of pulling a wagon, if any pull is necessary. The increased draft of an additional person up behind or of a rough bit of road will swing most pacers into a trot if they can trot at all. Jogging downhill will force some trotters to pace, while an up grade will set pacers to trotting. The pace is more essentially a speed than a road gait.

Running walk is a slow single foot or four-beat gait, intermediate between the walk and rack, suggestive of a continued breaking out of a walk. It is the business gait in the South and West, where gaited horses are ridden extensively, since it can be maintained all day. It is good for six to eight miles an hour, with the greatest possible ease to both horse and rider.

The foxtrot is a short, broken, nodding trot, in which the hind legs go in more or less of a lateral step. It is used as a substitute for the running walk.

The stepping pace is distinct from the ordinary pace of the harness horse, being characterized by very little if any side motion and a somewhat broken cadence in the action of the lateral pairs of legs.

Description of the Five Gaited Horse. The five gaited horse is distinct from the three gaited in the knowledge of gaits, and also in the manner of trimming. The five gaited is untrimmed and carries a full, flowing mane and full length tail. Usually the foretop and the first lock are braided and the mane is trained to the right. Three gaited horses are partially trimmed, having their manes "hogged" or clipped short and their tail "plucked" or shaved for a short distance from the base.

In horses of this class, dark colors are preferred. This includes chestnut, dark bay, brown, and black. Other colors, especially grays, are not uncommon, but conspicuous colors

or large white flashy markings are relatively uncommon. Since some of the gaits are not natural and must be acquired, those individuals without the desirable qualities are not trained in the gaits.

The desired size is usually within 1000 to 1150 pounds in



FIG. 276. A noted five gaited saddle horse, Hurricane, winner of the five gaited stake for geldings. 1940. International Livestock Exposition. Owned by Red Top Farm, Libertyville, Ill. Mr. Chester Caldwell up.

weight and 15 to 16 hands high. However, more range than this in size is prevalent.

In *conformation*, much stress is placed upon eye appeal. In other words, beauty of conformation is one of the paramount items in determining the value of the five gaited saddle horse. A good saddle horse should have symmetry and style, spirit

and animation, combined with tractability and ease in riding.

The *head* of the saddle horse should indicate intelligence, a tractable disposition, and refinement. The head is carried high on a rather long, shapely, refined, nicely arched *neck*. Such a neck with other suitable conformation gives the desired "much horse in front of the rider" which is regarded as adding to the rider's sense and ease in handling the horse. A short, thick, straight neck makes a saddle horse more difficult to control.

The *shoulders* should be long, sloping, and smoothly muscled. They should extend smoothly upward with rather high, well-defined withers. The saddle then will be placed well back, and with a deep, but rather narrow fore quarter, a comfortable seat will be given the rider. Well-set legs with ample slope of pasterns are essential for an easy ride. Such conformation will give the elasticity of step needed for a good saddle horse. The back of the saddle horse is relatively short, the croup comparatively level, and the under line rather long.

Saddle horses of this kind usually have their tails set. A well-carried flowing tail adds much to their attractiveness.

Although spirit and dash are desired in saddle horses, it is required that they respond promptly to the signals of the rider and that they be well mannered. By *temperament and disposition* the saddle horse should be well suited for his work. Riders prefer horses that have good dispositions, manners, and that are attractive and ride well.

The *action* of the saddle horse should be free, energetic, medium in height, and true. The step should be light and springy, and above all sure-footedness is an essential.

The *gaits* have been previously described. A five gaited horse must know and perform the prescribed gaits.

THE THREE GAITED SADDLE HORSE

These are the walk-trot-canter horses, and they meet the requirements for the five gaited saddle horse except that they perform only at three gaits. Three gaited horses are often referred to as "hacks." They may be of the American Saddle

Horse breed, but many come from Thoroughbred and Standard-bred breeding. The three gaited horse is the accepted saddle horse of England and this country, and they are preferred by the average rider.

Since the difference between five and three gaited horses is mainly performance, further description is unnecessary.

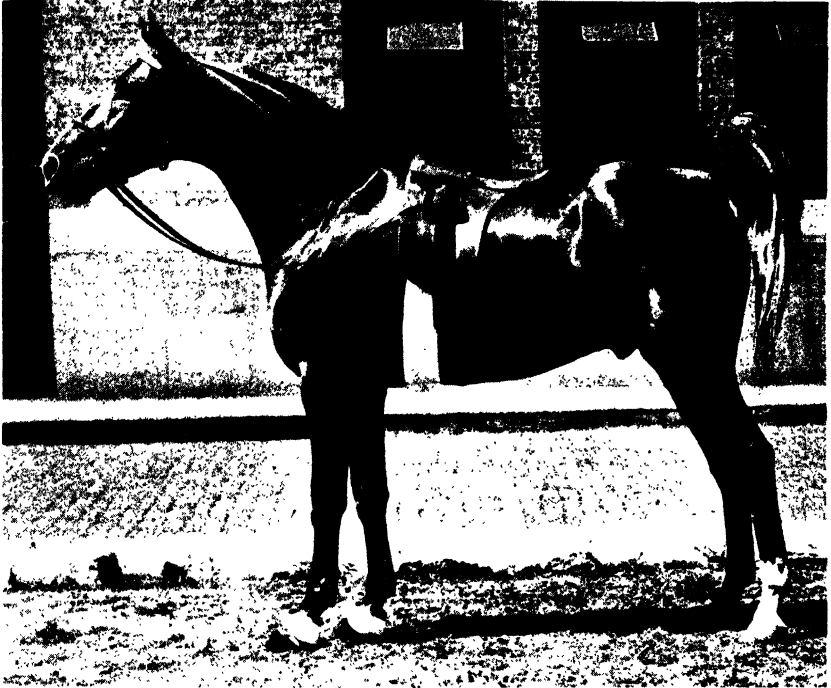


FIG. 277. A three gaited saddle horse, often called a walk-trot horse. The three gaits are the walk, trot, and canter. Horses of this type are shown with trimmed manes and tails.

E. A. Trowbridge ¹ states that there are four main considerations in evaluating saddle horses which are:

1. Conformation, including quality and soundness.
2. Action, including required gaits.
3. Manners, which include form, training, and obedience.
4. Personality, under which are included expression, attitude and physical make-up.

¹ American Society of Animal Production, *Proceedings*, p. 92, 1938.

The Hunter and Polo Pony

Much has been written about both of these specialized saddle horses. In breeding they are largely from the Thoroughbred.

The *hunter* is the type of horse used to follow the hounds in fox hunting. Therefore in this type size, ruggedness, and endurance are highly essential qualities.

The *polo pony* is used in playing the game polo. In this game men on horseback equipped with long-handled mallets compete in four-man teams on a playing field 300 yards long and 120 to 150 yards wide. The game is played in much the same fashion as hockey.

Fast, rugged, intelligent horses that can follow the ball are wanted in this game. Formerly ponies were used in polo, but now greater leeway is permitted in height. In height the range is from 14:2 to 15 hands, and the weight ranges from 850 to 1000 pounds.

Other Horses of the Saddle Type

As there are other horses used mainly as saddlers, they will be briefly discussed here.

THE ARABIAN

This is the oldest of the breeds of horses. It is recognized as the fountainhead of all our other light breeds and its influence has been felt in many other horse breeds. The Arabian is probably a descendant of the wild Libyan horse of northern Africa. As a breed the Arabian is noted for its beauty, style, quality, endurance, docility, and activity. It is used mainly under saddle, where it performs well at the walk, trot, and canter gaits.

In size the Arabian is from 14:1 to 15:1 hands high and will weigh from 850 to 1000 pounds. The common colors are grays, bays, chestnuts, and browns. Occasionally blacks and whites occur. White markings at the face and legs are common, but spotting usually attributed to the breed is mainly in the crosses.

One rather common criticism is the rather small size. However, Arabians have shown up exceedingly well in endurance

rides. The soundness, durability, and endurance of the breed are very good. They are less speedy than the Thoroughbred.



FIG. 278. A typical Arabian stallion, Jadaan. Owned by W. K. Kellogg, Arabian Horse Ranch, Panora, Calif. Courtesy of C. E. Howell, University of California.

This breed is quite popular in California and the southwestern states.

THE TENNESSEE WALKING HORSE

This breed was developed in middle Tennessee and the association of breeders was formed in 1935. Typical individuals stand about 15:2 and weigh from 1000 to 1250 pounds. Horses of this breed are noted for their good dispositions, gentleness, and intelligence. They are somewhat different than other saddle horses in that the running walk gait is emphasized. The head is somewhat low in carriage, and at the running walk there is a distinct nodding of the head and swinging of the ears. The gait is very easy on the horse and the rider. It is a natural

gait which is somewhat faster than a walk. The front foot strikes the ground just before the opposite hind foot, and the hind foot oversteps the front foot from 6 to 15 inches with a

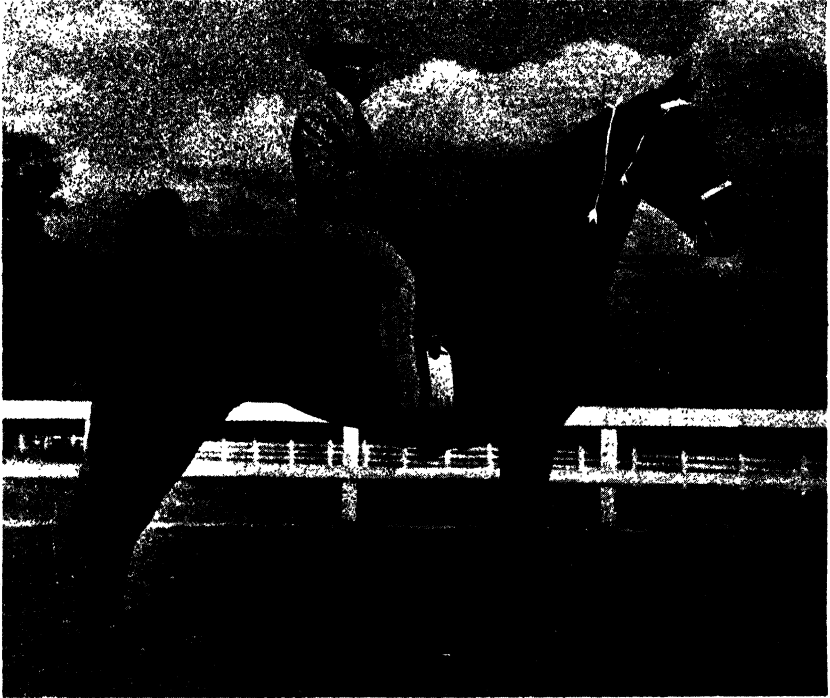


FIG. 279. A Tennessee Walking Horse, Melody Maid. Owned by Oakwood Acres Stables, Fayetteville, Tenn. Urban Small up.

sliding motion. A running walk, a flat-foot walk, and a good canter are required in classes for plantation horses.

THE PALOMINO¹

These are the golden-colored stock horses which have become very popular in the western states. The origin is probably from several sources in California, other western states, and Mexico. A register association has been formed and the first yearbook was issued in 1937. There is a good demand for such horses; in fact, they are light horses of riding type. Palo-

¹ Numerous articles by Robert Denhardt have appeared in *The Cattleman*, especially in the January 1939, September 1939, and March 1941 issues.

mino breeders are not wholly in agreement as to conformation and utility of the breed. The Palomino Exhibitors Association requires that in all Palomino breeding classes horses are to be shown at hand and must be registered in the Palomino Horse Association and Stud Book Registry.¹ Color is to count 50

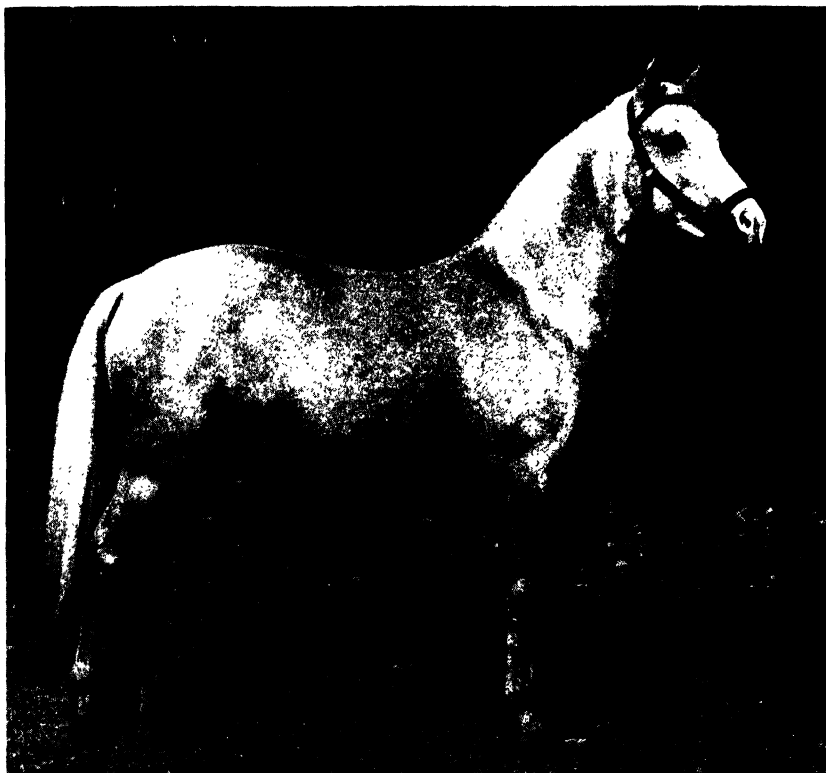


FIG. 280. A Palomino stallion, Rainbow, owned by Frank Fleisig, Tracy, Calif.

per cent and for a full score body color must be of pure gold. Mane and tail shall be white, ivory, or silver. The conformation of Palomino shall be judged on acceptable standards for western saddle horses or stock horses, and this shall count 40 per cent. Manners shall score 10 per cent, and emphasis is placed on docility combined with animation and alertness.

¹ From *Western Livestock Journal*, Vol. 18, No. 42, July 15, 1940.

THE QUARTER AND STEELDUST HORSE

These are essentially of the same type and origin. They both probably originated in Texas from the use of Thoroughbred stallions upon blocky, pony mares. The quarter horse is so called because of its ability to run a fast quarter mile under saddle. The quarter horse is mainly a stock horse or an ideal cow pony, and for this service intelligence and performance are essential.

Roadster or Light Harness Horses

Prior to the advent of the general use of automobiles the road horse performed an important role, that of furnishing rapid transportation. Horse and buggy travel has passed into oblivion except in remote areas, but there are times when such horses will still serve a useful purpose. Delivery horses and general-purpose farm horses are supplied from this type. Also horses of this type have survived for racing because of their speed at the trot and pace. Since the harness is made light to permit maximum speed on the road in racing, they are called light harness horses. As previously suggested, horses of this type have many uses other than racing as they are very versatile. When hitched for delivery the harness is heavier than for racing.

The light harness horse is distinctly an American creation, and the prevailing breed is the Standardbred or American Trotter. As implied by the name, these horses meet a certain standard which is speed, performance.¹ Within the breed the Hambletonian family is the most eminent, and this name is applied by some to the entire breed. Within the breed are some families which are mainly trotters while in others pacers predominate. It is not uncommon for some individuals to do both gaits well.

THE STANDARDBRED OR AMERICAN TROTTER

The standard is less uniform than some of the light horse breeds because size has to be secondary to speed. In weight,

¹ On January 1, 1933, registration on performance alone was no longer granted and registration of both the sire and dam was required.

light harness horses will range from 800 to 1250 pounds, and in height the range is from 14:2 to 16:2. The best specimens in racing condition weigh about 1100 pounds and stand about 15:2 hands.

The colors of bay, chestnut, brown, and black are common. There are a few grays and very few roans and duns.

Since speed is the major purpose for which this breed is raised, this is placed first in the requisites. Speed is imperative to

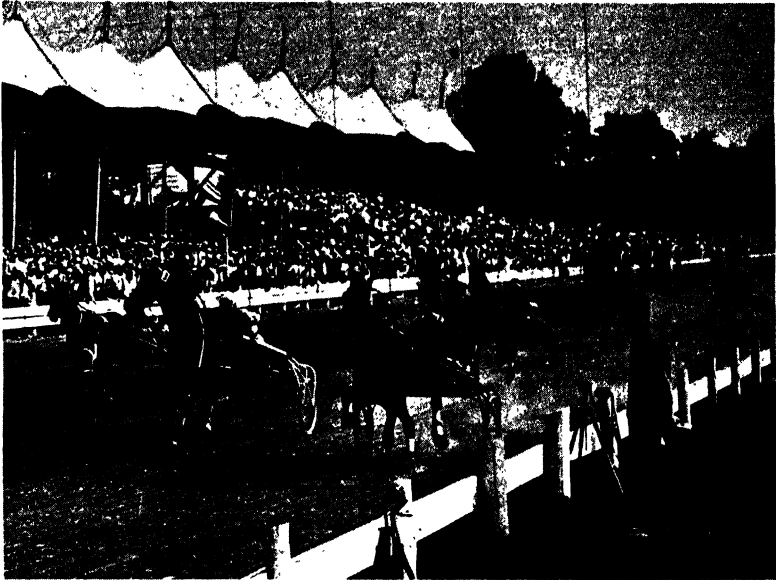


FIG. 281. Trotters in action. The Hambletonian trotting race on the mile track at Goshen, New York. Spencer Scott, driven by Fred Egan (nearest the rail), was the winner. (Acme.)

win in races and also roadster classes at horse shows. However, there are other rather important considerations in light harness horse selection. They are endurance, durability, temperament, and attractive conformation. The latter is subordinate to the other qualities. It is obvious that an obstinate temperament may influence the value. Also, to make a satisfactory performance in successive heats of race, or in races during a season, endurance and durability are essential.

In general appearance, the Standardbred is rather rangy,

leggy, deep-chested, narrow, and angular. The physical form has been secondary to speed in the selection. Maximum speed with a minimum draft is the requisite for the Standardbred.

The feet and legs are in most instances well set and clean. One rather common fault is the set of the legs, particularly in the hocks. Sickled hocks and cow hocks are not uncommon. The action should be straight, true, elastic, regular, uniform,

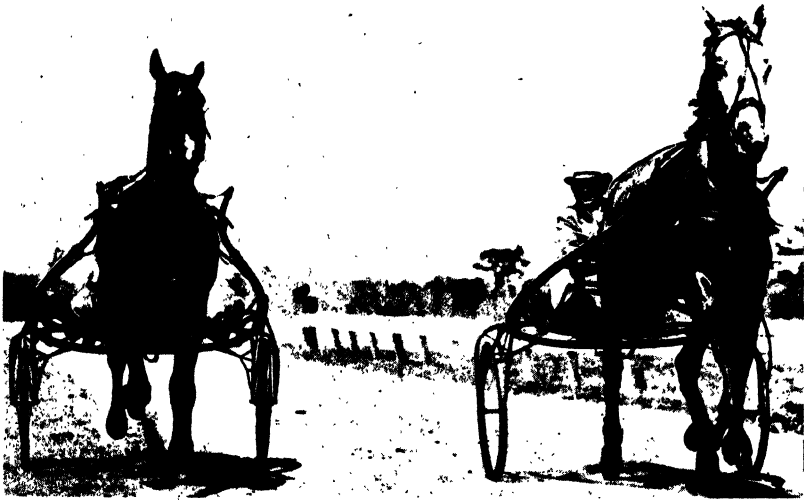


FIG. 282. A trotter and pacer in action. Greyhound, on the right, is a trotter. The right front and the left hind foot move forward at the same time, and vice versa. The pacer, Cardinal Prince, on the left, has a lateral coordination, that is, fore and hind legs on a side move forward at the same time. (Acme.)

and with a long stride. High action is undesirable since it reduces the speed and may cause undue exertion.

Gaits. Of the two speed gaits the pace is the faster. Consequently in performance the former standard for recording called for a record of one mile paced at 2.25 or better and a trot at 2.30 or better. In present-day recording an individual is accepted for register only if the progeny of a registered sire and dam.

Although the pace is usually faster than the trot, the latter is preferred, because of its smoothness, and the trot is superior

in mud. The lateral coordination of the pace and consequent rolling of the body is accompanied by a jerking of the vehicle.

RECORDS MADE BY STANDARDBREDS. Billy Direct, a stallion, holds the world's record for any driving horse on a mile racing track. On September 28, 1938, as a four year old, he paced a mile in 1 minute 55 seconds (1.55) at Lexington, Kentucky. Dan Patch, a stallion, as a nine year old paced a mile in 1.55 $\frac{1}{4}$ at Hamline, Minnesota. This latter record was made under somewhat unusual circumstances, since one horse going at a gallop or run but hitched to a sulky served as a windbreak.

Greyhound, a gelding, holds the mile record for trotting, made at Lexington, Kentucky, on September 19, 1938. The time was 1.55 $\frac{1}{4}$. At the time of the record, Greyhound was 6 years old. He was hitched to a regulation sulky.

The fastest records made by mares are, at the pace, Her Ladyship, with a record of 1.56 $\frac{3}{4}$ made at Lexington, and Rosaline, who holds the trotting record with a time of 1.57 $\frac{1}{4}$ made at Syracuse, New York. Both records were made in 1938.

MORGAN HORSES

The descendants of Justin Morgan¹ are known as "Morgans." This breed has played an important part in the formation of the Standardbred and the American Saddle Horse. It is considered by some as a family of the Standardbred, while others consider them as American Saddle Horses. An association of the breeders, "The Morgan Horse Club," organized in 1909, maintains a registry. As a breed Morgans are noted more as utility horses rather than for speed. In the area of their origin, New England, this breed has been widely used as general-purpose horses. From this breed have come individuals that have made creditable performances as saddlers, hunters, polo ponies, army horses, ranch horses, and carriage horses. This breed has made an excellent showing in quarter-mile cow pony races and in endurance rides.

In size, the average Morgan weighs about 1000 pounds and

¹ Justin Morgan was foaled in 1789 and lived for 32 years in Vermont. He was 14.2 hands high and weighed 950 pounds. He was noted for his speed, endurance, intelligence, and draft ability.

stands 16 hands high. The common colors are chestnut, brown, bay, and black, while white markings are not common.

The Carriage or Heavy-Harness Horse

This type of horse has been nearly replaced in the utility field and now is confined mostly to the show ring. Horses of this type are mainly an English development, where they were used as carriage or coach horses. They are called heavy harness horses to distinguish them from roadsters or light har-

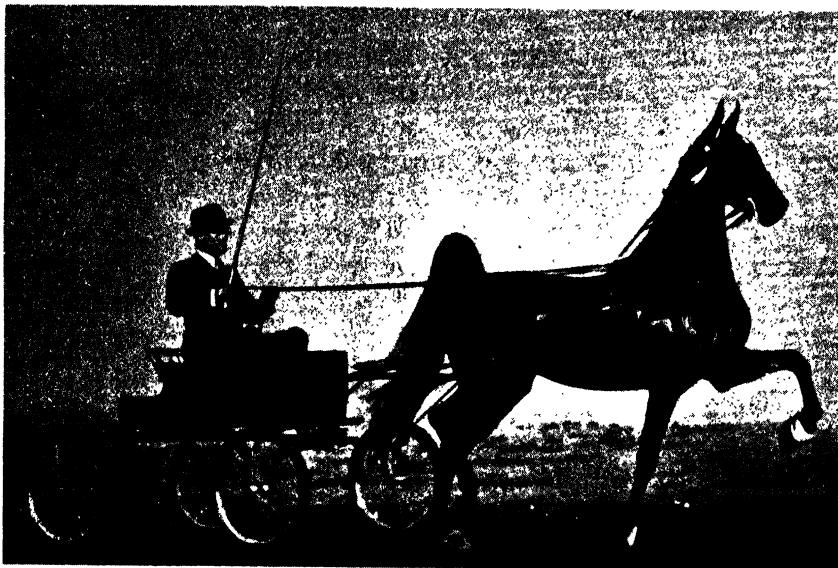


FIG. 283. A harness horse winner, Mountain Raven, winner of the fine harness horse stake, 1940 International Livestock Exposition. Owned by Red Top Farm, Libertyville, Ill.

ness horses. Although the harness used is heavy it is in no sense a draft harness.

At one time there were several breeds of this type, but at present the heavy harness breeds other than the Hackney have gone out of existence.

The Hackney rarely stands higher than 15:3. In fact, some are in the pony class, that is, under 14:2. In weight they will range from 800 to 1300 pounds. Chestnut, bay, brown, and black are common colors, and white markings are quite common.

Compared with the other type light horses, the heavy harness

horse is rather heavily made, heavy fronted, and short legged. Fullness and smoothness of form are desired in the heavy harness type rather than angularity of conformation. Quality and refinement are essential for the requisite beauty of conformation. The natural action at the trot is characterized by extreme height. The shoeing and training is directed toward development of a high, trappy action.

Since the Hackney is primarily a show horse, qualities which enhance the attractiveness are given preference to those which



FIG. 284. A champion Hackney pony, Superlative, imported from England. Owned by Nan-Su Farm, Northbrook, Ill. (James Gilchrist, Manager.)

denote service. In other words, endurance and durability are required in the heavy harness horse, but they are subordinate to style, beauty, flashy action and striking performance.

Ponies

There are three breeds of ponies in the United States: The Shetland, the Welch, and the Hackney. The upper limit in the pony class is a height of 14:2 hands. Hackneys and Welch ponies are the larger of the ponies, and from these come most of the show ponies in the driving and riding classes. Hackney

ponies with beauty of conformation and high flashy action are shown in the heavy harness classes.

The Shetland is limited to a maximum of 42 inches or 10:2 hands in height. Being small in size and docile in disposition, this pony is popular as a children's pony.

Remount Horses

The Remount Branch of the Quartermaster Corps of the U. S. Army will furnish stallions of suitable riding type to civilian agents who agree to certain regulations. One of these is that each stallion should be bred to 20 or more mares per year. The objective of the plan is the production of sufficient horses suitable for army service in the cavalry and artillery.

In 1937 the number of stallions in such service were 618 Thoroughbred, 17 Arabian, 14 Morgan, and 3 American Saddle Horses. The regular requirements for army horses are included in the chapter on horse marketing.

Chapter 41

HORSE AND MULE MARKETS

There has been a greater change in the marketing of horses and mules, both as to place of sale and general movements, than in that of other classes of livestock. Central market sales declined markedly, and sale barn auction sales have increased. The decline in numbers of horses has been greatest in regions that usually purchase a large portion of the work stock and least in the surplus production areas. With mules the reverse has been the case, that is, the reduction has been the greatest in the producing areas and the least in the areas that purchase replacements.

Areas of Horse Raising

The marketing movement of horses and mules is from the western and central part of the country toward the south and the east. The bulk of the supply of marketable horses and mules is from the states of North and South Dakota, Nebraska, Kansas, Oklahoma, Iowa, Missouri, Illinois, Indiana, and Ohio. The mountain states and Texas produce a surplus of good range horses quite acceptable to the trade. In fact, it is only in these states that the production has been sufficient to offset the mortality rate in recent years. Our northeastern states import many work animals, while the southeastern states are the farthest from being self-sufficient in work stock production. The least sufficient or deficit areas are to the east and the south. This demand is supplied by the excess production from the western and midwestern states.

The lessened demand for city horses has had a marked influence upon the place and manner of marketing horses. The extent of the decrease in the use of horses not on farms is shown in the next paragraph.

Horses Not on Farms

The horse population not on farms has declined much more than that on farms. From 1910 to 1930 the number of horses in cities and on construction projects, etc., had declined nearly 3 million head. This change in numbers is shown in the data that follow:

HORSES—NUMBER NOT ON FARMS, UNITED STATES
CENSUS YEARS: 1900, 1910, 1920, 1930¹

<i>Census Year</i>	<i>Horses Not on Farms, Number</i>
1900 (June 1)	2,936,881
1910 (April 15)	3,182,789
1920 (January 1)	1,705,611
1930 *	300,000

* U.S.D.A. estimate.

The decline in number of horses and mules in cities started before the decline on the farms. In fact, when the city horses and mules are considered the peak of population was reached in 1913 or 1914. Heavy exportation during the first World War was also a check on the total population rise. Heavy production continued on farms until 1915. Mules continued to expand in cities after horse numbers declined, indicating a shift from horses to mules.

The replacement of horses and mules by automobiles and trucks in the cities has been quite complete, with the exception of hauling for short distances and where frequent stops are made.

Large Horse and Mule Markets

There is much shifting around in the rank of the horse and mule markets on the basis of yearly receipts. The data available on receipts do not separate horses from mules; consequently discussion of the marketing of horses also includes mules. Horse markets developed with the central markets for other livestock. There follows a list of large horse and mule markets ranked on total receipts for five years.

¹ Division of Statistical and Historical Research, B.A.E. Compiled from reports of the Bureau of the Census.

LEADING MARKETS OF HORSES AND MULES
AT PUBLIC STOCKYARDS, BASED UPON RECEIPTS AND
AVERAGE YEARLY RECEIPTS FOR THE 1936-1940 PERIOD

<i>Market</i>	<i>Average Yearly Receipts, Head</i>
Memphis	54,500
National Stockyards, Illinois	40,293
Kansas City, Missouri	38,869
Fort Worth	37,489
Atlanta	19,099
Omaha	16,054
Pittsburgh	13,633
Oklahoma City	13,021
Buffalo	12,867
South St. Paul	12,475
Chicago	11,086
Sioux City, Iowa	9,657
Wichita	8,746
Denver	8,047
Nashville	5,372

The above rank is based on a five-year period, but there has been much shifting around in rank. Memphis, for example, ranked first four of the five years, but the other year it was in fourth place.

Central market horse sales have declined materially in numbers. Two conditions are responsible for this change, first, the decline in horse numbers, and second, the growth of markets at places other than at the central or terminal markets. For a period up to and including 1920 the receipts of horses and mules at public stock markets exceeded a million head annually. By 1930 the receipts had declined to 346,000, and in 1940 they were but 236,000 head.

Some points other than the central markets handle a large number of horses and mules. For example, Anna, Illinois, has laid claim to being the largest horse and mule market in the country, the volume being from 500 to 600 weekly.

Marketing Costs

Sale costs vary in the different markets. The usual sale cost is about \$4.00, which includes feed, water, halter, yardage, insurance, and commission.

Market Classification of Horses

Horses are classified according to their usefulness, which is based upon size (weight and height), conformation, perform-

ance, and training. Listed below are the usual market classes for horses.

General Classes

Draft horses
Chunks
Wagon horses
Saddle horses
Ponies

Under the section on horse prices, page 694, the prices of the different classes are given. A brief description of each class follows.

DRAFT HORSES

Draft horses, weight from 1600 pounds upwards, stand from 16 to 17:1 hands high. The draft type has been previously



FIG. 285. A good draft gelding. (Wayne Jackson, Iowa State Department of Agriculture.)

described, and the value of such horses is in accordance with meeting the specification for that type and evidence of serviceability. The demand for big heavy draft horses for city use is

now rather small, as is the demand for big heavy coarse horses at one time widely used in lumber camps.

CHUNKS

This group is made up of undersized draft horses. *Farm chunks* are suited mainly for farm work and stand from 15 to 16

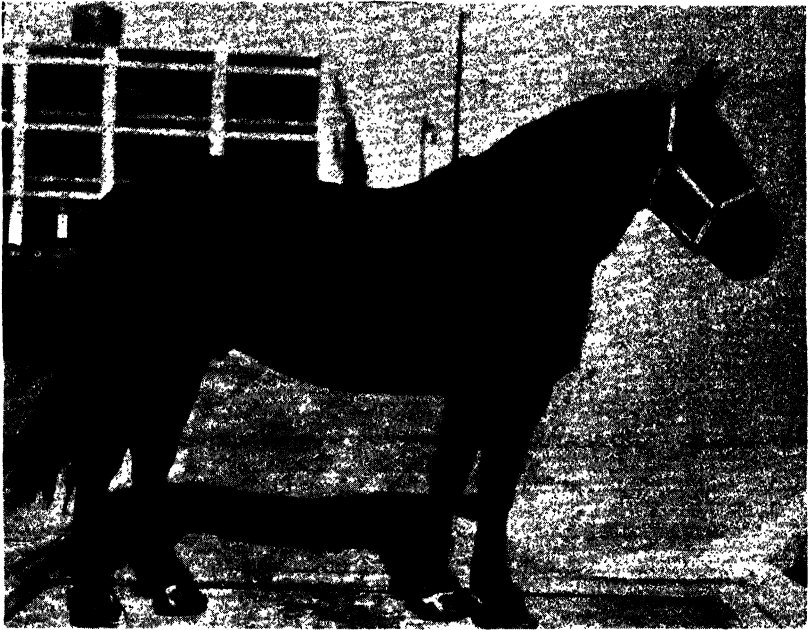


FIG. 286. A good wagon horse, weight, 1600 pounds; height, 16 hands, 3 inches; age, 8 years. This horse had three years in service at the Bowman Dairy, Chicago, Ill. (Horse and Mule Association of America.)

hands in height and weigh from 1500 to 1650 pounds. The size desired is dependent upon the section in which they are demanded. Those needed for eastern farms are somewhat smaller than those wanted for farms in the central states. *Southern chunks* are a little smaller, standing from 14:2 to 15:2 and weighing from 800 to 1100 pounds. This latter group find a market in the south and are adapted to work on southern plantations.

WAGON HORSES

Rather active undersize draft horses standing from 15:2 to 16:2 hands high and weighing from 1350 to 1650 pounds are called "wagon horses" on the market. Compared with draft horses they are less muscular and drafty. They are also more leggy and have higher quality. The wagon horses must trot well.

SADDLE HORSES

Although horses suitable for saddle use are but a small proportion of the total horse sales, the number has increased and the demand has been good.

PONIES

A limited number of ponies pass through the various markets, but most of them are sold direct.

Prices for Different Market Classes

Yearly average prices on several market classes are available from the Union Stock Market at Chicago. Following is an average and range of the yearly prices for a ten-year period, 1931-1940.

Market Class	Range		
	Average	Low	High
Draft horses	\$132	\$105	\$150
Delivery—wagon horses	126	100	140
Farm chunks	93	75	115
Saddlers—medium quality	195	125	350
Saddlers—good to choice quality	557	350	750

The prices for saddle horses did not follow those for other horses. The latter were at a low for the period in 1940 and saddle horses were at a high. For example, in 1940 draft horses actually averaged \$105 while good quality saddle horses sold for an average of \$750. The supply in proportion to the demand was not the same for the work horses and the pleasure horses.

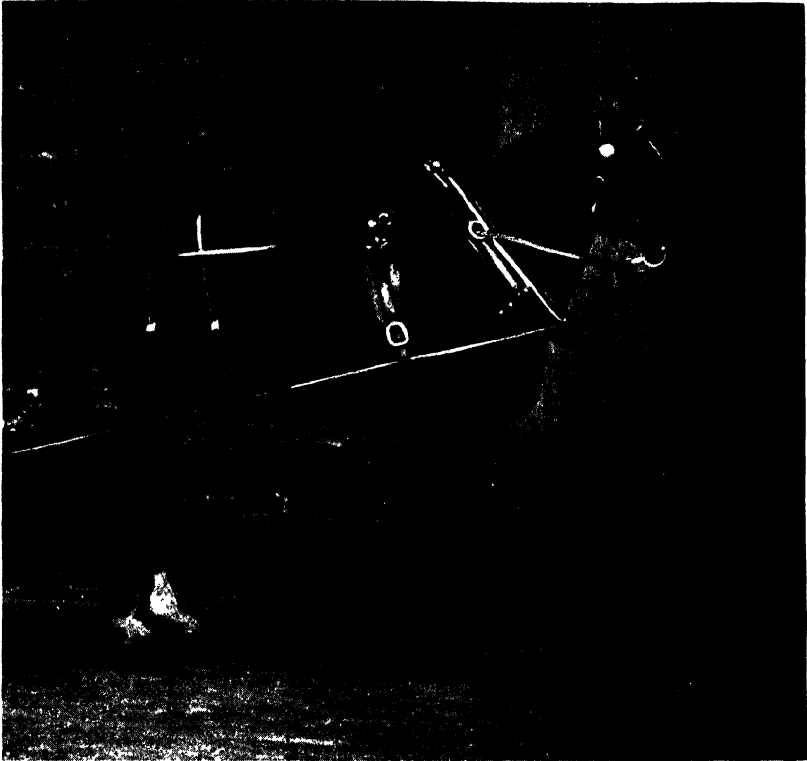


FIG. 287. A light delivery or wagon horse. Weight, 1375 pounds in good flesh; age, 21 when photograph was taken; height, just under 15 hands. Regarded by Wayne Dinsmore as a very fine type of light delivery horse with height, heart girth, and weight ample for light delivery work. (Horse and Mule Association of America.)

Factors Determining Value of Horses

In the sale of horses and mules or work stock the differences in sale value are due mainly to such things as soundness, action, condition, quality, conformation, age, disposition, and some minor points. There is also a price differential between the type and market classes of horses, as is shown on page 694. A brief discussion of the above factors follows.

SOUNDNESS

Most horses offered for sale are serviceably sound, that is, capable of satisfactory performance. This does not exclude

blemishes or minor defects. Unsound horses are severely discriminated against for the reason that their future usefulness is uncertain. So important is the matter of soundness that a discussion of the common unsoundnesses is included in Chapter 42.

ACTION

The attributes of good action have been discussed. Good action is essential for a top or near top value.

CONFORMATION

Ideal conformation has been previously described. It is an important item in market value.

CONDITION

Although fatness may not affect a horse's capacity to work, it is a big factor in the general appearance, and as such affects the selling price. Thin bony horses invariably sell for less than comparable individuals in higher flesh.

QUALITY

Good quality is essential for market horses to be in demand. Plain, coarse, rough horses are severely discriminated against on the market.

AGE

It is common to estimate that the average life span of a horse is about 15 years, while that of mules is about 18 years. The

INFLUENCE OF AGE ON VALUE OF WORK HORSES¹

<i>Age</i>	<i>Per cent of Maximum Value</i>	<i>Age</i>	<i>Per cent of Maximum Value</i>
Birth	16	8 years	96
6 months	25	9 years	91
1 year	38	10 years	84
2 years	57	11 years	76
3 years	74	12 years	70
4 years	88	13 years	62
5 years	97	14 years	55
6 years	99	15 years	48
Maximum	100	16 years	40
7 years	99		

¹ *The Farm Horse*, U. S. Dept. of Commerce, Bureau of Census, 1933.

age of the horse is related to its probable period of usefulness, and therefore is of importance. The influence of age on the value of work horses is indicated in the table on page 696.

SEX

Geldings commonly sell for higher prices than mares because of their greater adaptability. Mares are discriminated against for city trade and also for the army, because they may be in foal and also because of the disturbance they may cause when they are in heat. When the demand is from the farm trade, mares may outsell geldings, as the ability to reproduce adds to the farm value of the horse.

FRESHNESS

This is another quality that influences the selling price. Horses that appear to be somewhat second-hand because of blemishes or minor unsoundnesses are discriminated against. Buyers prefer horses fresh from the country.

COLOR

The light colored horses are generally not in such strong demand as those with darker colors. Blacks, bays, or browns sell equally well. Dapple grays and roans are in somewhat greater demand for the available supply on the Chicago markets. Chestnuts with light manes and tails bring the highest prices on most markets.

DISPOSITION AND TRAINING

Tractability is a prerequisite for a good horse, and evidence of poor disposition is a factor in the price. "Greenness" or lack of training may not affect the value, provided the individual handles well.

VICES AND BAD HABITS

There are some habits and vices which affect salability. Cribbers, windsuckers, weavers, tongue lollers, tail rubbers, and their like are worth less than individuals not showing such traits.

Auction Sale Rules

A large proportion of horses marketed are sold at auction. At the central markets there are private sales as well as sale by auction, and these take place prior to the time of the auction. Sales at the sale barns are nearly always at auction. At auction sales all the individuals offered for sale are carefully examined, and are winded. The results of that examination are announced when the animal is brought into the show ring.

Some general specifications understandable to both buyers and sellers are in common use in auction sales. Signs are displayed at the start of a sale of an individual horse which indicate the nature of the seller's guarantee. Common guarantees are sound, serviceably sound, wind and work, work only, legs go, and at the halter. A previously agreed length of time is permitted the buyer to reject the purchase. The rules and their meanings briefly are:

1. Sound. Free from unsoundnesses or blemishes of any kind.
2. Serviceably sound. Such horses have but slight imperfections which will have no appreciable effect upon the serviceability for which they are sold.
3. Wind and work. Such a limit upon guarantee implies unsoundness, but does warrant good wind with ability and willingness to work.
4. Work only. When sold with this limitation of guarantee only willingness and ability to work are assured by the seller.
5. Legs go. This sale condition indicates unsoundnesses and blemishes on the legs, in other words, the legs are not guaranteed in any way.
6. At the halter. When sold at the halter the buyer has no assurance of performance from the seller. Individuals sold with no more guarantee are likely to be noticeably unsound. These are very often horses that have been rejected in previous sales, and may be poor workers.

There are many other rather commonly used sale terms which describe certain conditions and these are announced at the time of sale. Some of the common terms and their meanings are:

Smooth mouth. The mouth is smooth, having lost by wear the cups in the teeth, which would indicate more than ten years

of age. In fact, when so indicated the actual age is probably considerably over ten years.

Good mouth. This indicates a mouth that shows an age of about ten years.

Gristle on the heel, or hard on the heel, indicates one or more side bones.

Crampy. This term (or "stringy" or "jerky") is used to designate a horse that is string-halted.

Green Broke. A horse not completely broken.

Wire. A scar from a cut probably caused by a wire is often referred to as a wire.

Plain ankles. This indicates swelling or puffiness about the ankles.

Blue eye, smoky, speck. These are a few of the several ways of describing a deviation from a normal appearance of the eye, and these conditions indicate an impaired vision.

Army Horses

Horses outnumber mules in the army service, and riding horses are more numerous than those used principally for draft. In June 30, 1941, there were 40,166 horses and 7015 mules in the United States Army.¹

Based upon the principal uses in the army, horses and mules were divided as follows: riding horses, 36,887; draft horses, 3279; draft mules, 1300; pack mules, 5715. Most of the horses and mules are in the Cavalry branch of the army service, followed by the Field Artillery.

Specifications for Army Horses and Mules

The War Department uses horses and mules of the following classes. Riding horses; riding horses light; draft horses; light draft mules; heavy draft mules; and pack mules.

¹ Information from Charlie B. Team, First Lt. Q.M.C., October 13, 1941.

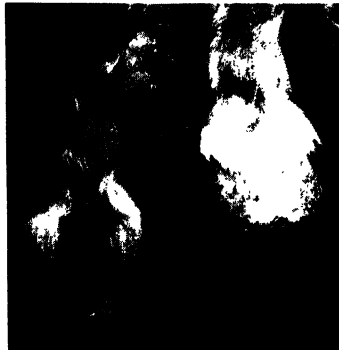


FIG. 288. Shoes help poor feet. Shoes are needed when horses or mules are worked hard on hard surfaces.

The special specifications for all horses and mules except young horses are included in the following tabulation. Not included in the table is the *age*, which for all classes is from four to eight years at the time of purchase. *Young horses* are those from two to four years old that will develop into the classes required. *Color*. The colors desired are chestnut, brown, black, and bay. No grays, duns, or spotted horses are desired, but outstanding grays and duns may be bought occasionally.

Sex. The gelding is preferred; however, 5 per cent of mares¹ are purchased.

The other special specifications follow.

	<i>Riding Horses</i>	<i>Riding Horses, Light</i>	<i>Light Draft Horses</i>	<i>Heavy Draft Horses</i>
General requirements	The horse should be well broken to saddle and comfortable to ride and should possess square and elastic gaits at the walk, trot, and gallop only. Ability to live on short rations, to carry 260 to 270 pounds, and to keep going at moderate speed are essential requirements. To keep going is more essential than a burst of speed.	Same as for riding horses, except as to weight-carrying capacity, which will be from 225 to 245 pounds.	The light draft horse is required for quick draft action and should be active, with enough weight to move the load without great exertion; should be well broken to harness and saddle and have free and elastic gaits at the walk, trot, and gallop only.	A heavy draft horse is required for heavier and slower work than a light draft, with enough quality to ensure staying power in fairly fast work; must be well broken to harness and have free and elastic gaits at walk and trot.
Height	From 15 to 16 hands.	From 14½ to 15 hands.	From 15½ to 16 hands.	From 15¾ to 16½ hands.
Weight	From 950 to 1200 pounds, depending on height.	From 850 to 1000 pounds, depending on height.	From 1180 to 1300 pounds, depending on height.	From 1450 to 1700 pounds, depending on height.

Riding or light horses predominate in the army. The work formerly done by drafters is now being done quite largely by trucks and tractors. However, there is still a place for the horse in present-day warfare.

¹ Mares cause more trouble on the picket line as they fight when they are in heat, and it is desired to leave the best mares in the country for breeding purposes.

	<i>Light Draft Mules</i>	<i>Heavy Draft Mules</i>	<i>Pack Mules</i>
General requirements	Light draft mules should be fast walkers, with a good square trot, and be well broken to harness. Riding mules for use with wagon transportation will be selected from light draft mules.	Heavy draft mules should be fast walkers, with a good square trot, and be well broken to harness.	Pack mules should be of stocky build, short neck, short strong back and loins, low withers, large barrel, straight strong legs with heavy bone, pasterns short and strong and not too oblique. Riding mules for use of pack trains will be selected from pack mules.
Height	From 15¼ to 15¾ hands.	From 15¾ to 16¼ hands.	From 14¾ to 15½ hands.
Weight	From 1000 to 1200 pounds, depending on height.	From 1200 to 1500 pounds, depending on height.	From 1000 to 1200 pounds, depending on height.

Average Value of Farm Horses and Mules

Since the depression period in the early '30's horse and mule prices have shown an upward trend. The average price for horses and mules was higher in 1940 than a decade earlier. Below is the average value of horses and mules in the census years from 1910 to 1940 inclusive. An index here based upon the 1910 prices is also included.

<i>Average Value Per Head</i>		<i>Price Index Based on 1910 Prices</i>	
<i>Horses</i>	<i>Mules</i>	<i>Horses</i>	<i>Mules</i>
1910	\$105.06	100	100
1920	90.15	85.8	114.9
1930	67.51	64.3	66.2
1940	77.36	73.6	91.40

With the decrease in demand from the city markets, work stock became wholly dependent upon the farm demand. When farm purchasing power is low, as has been the case often in the past, work animals feel the full brunt, and low prices prevail.

Cycles in Horse Prices

As we have had periods of over- and underproduction in horses, cycles in horse prices have occurred. Even though the

numbers in use have decreased, we probably will continue to have distinct changes in numbers which will be related to prices. When horse production is not profitable, colt raising is checked, but reduction in work horses is delayed until the smaller colt crops become of workable age. More serious is the reverse of this process, for when we have a shortage of work horses there is also a shortage of several colt crops. As reproduction and maturity are slower processes in horses than in other kinds of livestock, cycles in production, or over- and underproduction, are slower in completion. In other words, peaks of production are comparatively far apart. The purchasing value of horses and mules has advanced and declined quite regularly for 12 to 13 years, thus completing the cycle in about a quarter of a century.

Slaughter of Horses

There is some slaughter of horses under federal inspection. This declined during the period 1930-1940. Horse meat is used to some extent as human food, and some of it is utilized in animal food products. Horses of little or limited use for work find an outlet for this use. There has never been any sizable slaughter which would absorb a surplus production. The proportion slaughtered under federal inspection is probably but a small fraction of the total slaughter. Old or incapacitated horses are often disposed of in the country yielding hides which enter the trade and carcasses used for feeding.

HORSES — FEDERALLY INSPECTED SLAUGHTER, UNITED STATES, 1930-1940¹

<i>Calendar Year</i>	<i>Number of Horses</i>
1930	138,827
1931	118,001
1932	64,165
1933	42,304
1934	19,662
1935	17,882
1936	12,960
1937	13,937
1938	24,015
1939	27,486
1940	18,750

¹ Division of Statistical and Historical Research, Bureau of Agricultural Economics. Compiled from reports of Agricultural Marketing Service.

The number of horses slaughtered annually under federal inspection is listed on page 702.

Export and Import of Horses and Mules

Exports of horses have been very irregular. In the decade 1910-1920, over a million horses and 300,000 mules were exported. This demand was caused by the First World War. Since that the exports and imports have been negligible.

Chapter 42

UNSOUNDNESS OF THE HORSE

In addition to estimating the value of the horse on his type or conformation, we must also consider his soundness or freedom from functional defects. A horse acceptable or nearly ideal in type may be unsound and consequently of much lower market value. In horse judging, we consider first the type, and second, the unsoundness. Too often the uninformed will put undue emphasis upon soundness. The accurate determination of soundness requires the capabilities of a well-informed person. Consequently, the beginner should seek the advice of experts on soundness. Often among experts there is a difference of opinion as to the extent or even the presence of an unsoundness and also its probable outcome.

The purpose of this chapter is to give some understanding of the different unsoundnesses and the emphasis or weight given them in selecting or judging horses. It is obvious that considerable experience is needed to identify an unsoundness and its probable outcome or effect, especially in a borderline case. In show ring judging the matter of soundness may be decided by a veterinarian.

A sound horse is one that is free from defects which may interfere with the ordinary performance of duties required of his type. A deviation from the normal condition which affects functioning is an unsoundness. These defects are not those included in type, for example, fine bone, small feet, etc., but rather imperfections having to do with function. A horse good in type may have an unsoundness, although this is not usual. An unsound horse is impaired in his performance by defects. For example, side bones will, if sufficiently large, detract from the working ability of a draft horse.

A horse may have a blemish which, as contrasted with an unsoundness, does not interfere with the performance of usual

tasks. A wire cut is a blemish if it merely detracts from the appearance and does not affect the work ability of the individual. It is quite obvious that the border line between an unsoundness and a blemish may not be too definite. However, if the horse can do work ordinarily required he should be regarded as sound; a blemish is commonly regarded as being rather superficial and detracting from his appearance, while an unsoundness may or may not be superficial, but constitutes a definite imperfection.

On the market horses are frequently referred to as being "serviceably sound" which means that the horse may have defects that do not interfere with fitness for the service for which he is sold.

Causes of Unsoundnesses

Most of the unsoundness occurs where there is a definite defect in conformation. However, with reasonably good conformation an unsoundness may arise as a result of strain, injury, disease, or improper handling. Whether or not an unsoundness will occur will depend upon resistance to the causative conditions. If a horse is worked hard and given poor care it stands to reason that defects will crop out. The care of the feet may have an important bearing upon the soundness of the legs. If the structural parts such as the legs are imperfectly aligned even moderately heavy work may cause an unsound condition to appear. Improper trimming or shoeing can very easily cause a not too strong conformation to weaken. It has been shown that the ration may be related to a soundness of the limbs. Horses fed for a long period on poor rations such as oat straw alone will often develop unsoundnesses.

Some of the unsoundnesses are hereditary. Consequently, in breeding, such conditions are to be selected against. Certain standards of soundness are included in the requirements for license of stallions for public service, which are based on the assumption that at least the predisposition is heritable. Faulty conformation predisposes to unsoundnesses.

Heritable unsoundnesses or diseases are cause for refusal of licensing for public service, but there is a difference of opinion on the transmissibility of the different abnormalities. During the 33 years of the Minnesota Stallion Registration Board,

533 stallions and jacks have been rejected. The causes for rejections were side bones — 334, bone spavin — 88, roaring — 39, ringbone — 33, cataract — 18, curb — 6, and others — 13.

Bone spavin, ring bone, heaves, string halt, roaring, partial or complete blindness, and periodic blindness or moon blindness are regarded as sufficient to bar a mare from service to a U.S.D.A.-B.A.I. stallion.

It is apparent that with an unsoundness due to an injury or improper handling or other nonheritable conditions, selection may be of no avail unless a greater resistance or stronger conformation results. However, horse breeding should be directed toward a serviceability of conformation or ability to resist unsound conditions.

Under heritable unsoundnesses are listed such abnormal conditions as side bone, bone spavin, bog spavin, thoroughpin, curb, string halt, moon blindness, cataract, heaves, roaring, and others. Even though we may regard the above as at least partially hereditary, conditions of environment influence their manifestation.

Unsoundness and Degree of Discrimination

In general the extent of the abnormal condition determines the emphasis given to it in the appraisal of a horse. In many cases we see in an unsoundness the attempt to repair a weakness. For example, calcification is increased to strengthen a weak structure in the case of a bone spavin.

Yet certain unsoundnesses are definitely regarded as distinct disqualification while others are the cause of discrimination. A committee of the Percheron Judges and Breeders made the following recommendations on unsoundness, which were adopted at their judging conference.

Disqualification was recommended for cases of the unsoundnesses which follow: lameness, blindness, ringbone, bone spavin, stifled, string halt, or windy; a stallion with one testicle or possessed of abnormal testicles.

Moderate to serious discrimination was recommended for cases of side bones, curb, filled hock or ankle, bog spavin, thoroughpin, cocked ankle, capped hock, poll-evil, fistula of the withers, or umbilical rupture.

The Common Unsoundnesses

A brief description of the common unsoundnesses of the horse follows. A figure showing the location of these faults is shown on this page. For convenience they are divided on the basis of

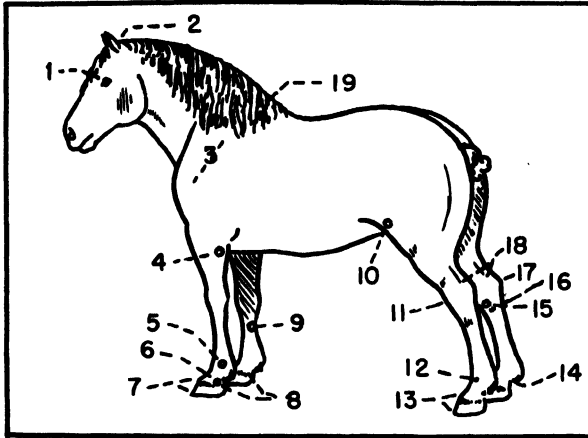


FIG. 289. Unsoundness of a horse.

- | | |
|------------------------------|---------------------------------|
| 1. Defective eyes | 11. Bog spavin and blood spavin |
| 2. Poll-evil | 12. Cocked ankle or knuckling |
| 3. Sweeney of the shoulder | 13. Founder, quarter crack |
| 4. Capped elbow or shoe boil | 14. Grease heel, scratches |
| 5. Windgalls | 15. Bone spavin |
| 6. Ringbone | 16. Curb |
| 7. Founder | 17. Capped hock |
| 8. Sidebone | 18. Thoroughpin |
| 9. Splint | 19. Fistula of the withers |
| 10. Stifled | |

the seat of their occurrence, that is, feet and legs, wind, head, body, and vices.

UNSOUNDNESS OF THE FEET AND LEGS

These are far more numerous than imperfections in other divisions. Since they have to do with lameness or the work capacity of the horse they are of primary importance. Lameness is one of the indications of unsoundness. Therefore, horses should be moved sufficiently to make a good test for lameness. It should be pointed out that in some instances the lameness may show up at first exercising the horse, and then disappear,

while the reverse may be true of others. For example, lameness due to splints usually becomes worse with exercising, while spavins commonly affect action in the reverse manner. Some of the common defects are:

SIDE BONES. This is one of the common unsound conditions of horses, especially those of the draft type that are over two years of age. It is the hardening or ossification of the lateral cartilage of the foot, which is normally quite elastic. A sizable side bone is noticeable as it is a bony projection on the hoof head toward the heel. Side bones are more common on the outside cartilage of the foot and on the front legs. Seldom do they occur on the hind limbs, and if present there they seldom cause lameness. In the examination for soundness the hoof head is handled with the thumb or fingers and the presence or absence of a side bone is determined with the hardness. Since the side bones prevent normal expansion at the heels, the shock-absorbing mechanism is interfered with. Side bones will cause a shortening of the stride and often will cause lameness. The side bones vary greatly in size and their effect on action.

Individuals that have short straight pasterns, narrow heels, and that stand toed in often have side bones.

RINGBONES. A bony enlargement involving the pastern bone is known as a ringbone. They may appear anywhere between fetlock and the foot on the front leg and they may encircle the pastern. Draft horses are less subject to this unsoundness than light horses. As normal movement is restricted by such growths, lameness may result. The severity is dependent upon the location with respect to the moving parts. Short pasterns, small feet, or small hoof heads are a predisposing cause, and the immediate cause may be a sprain, bruise, overwork, or incorrect shoeing.

COCKED ANKLE OR KNUCKLING OVER. This condition appears more often in the rear ankles or pasterns than the front. It is often referred to as knuckling over, and fetlock or pastern joint is not in normal position as there is a contracting of the tendons and the fetlock often is forced forward. It may be a serious condition depending upon the extent of the abnormality. In colts it is often overcome, but in older horses it is generally quite serious.

The typical conformation associated with the cocked ankle is a short, straight, pastern, and often it results from hard usage or improper shoeing or trimming of the feet.

SAND CRACKS OR QUARTER CRACK. This is a vertical split in the wall of the hoof that results from improper hoof growth or shoeing. Dry, brittle hoofs are more susceptible to cracking than normal feet. A quarter crack is on the side of the hoof while a toe crack is on the fore part. The latter are more common on the hind feet, while the quarter cracks are commonly found on the front feet.

QUITTOR. This is a rather deep-seated, discharging sore at the hoof head. Quittor is more common on the fore legs, and very often it results in severe lameness. The severity depends upon the involvement. Since they are difficult to heal, quittors detract materially from the value of a horse.

THRUSH. This is a disease of the cleft or horny layers of the frog characterized by foul-smelling discharges. It results from unsanitary conditions and is similar to foot rot. Cleanliness of the stable yards and the feet is required for its control.

GREASE. This is often called "scratches" and is a skin disease or mange on the rear of the fetlocks. It occurs near the heels and therefore may be termed "grease-heel."

CONTRACTED FEET. This condition, which usually appears on the forelegs, is a drawing in or contracting at the heels. This first causes a weakness and a common result is lameness.

CORNS. These are on the sole of the foot and are caused by bruises to the soft tissues underlying the horny part of the sole. They occur mainly in horses worked on hard ground or pavement, especially if the feet are in poor condition, that is, hard and brittle and contracted and low at the heels.

FOUNDER OR LAMINITIS. Some disturbances in the nutrition of the horse will result in laminitis or inflammation of the fleshy part of the hoof. Overwork, disease, and perhaps other conditions may cause founder. In the founder foot the sole is dropped, the toe is turned up, and small ridges appear around the foot. The front feet are commonly affected and the front feet often are extended forward to put more of the weight on the hind legs which are drawn up under the body. A severe case will incapacitate an individual for work.

NAVICULAR DISEASE. As implied by the name, this is a disturbance of the navicular bone. It occurs mainly in light horses and generally involves the front feet. It is a serious unsoundness, but it is not easily identified.

SPLINTS. A splint is a hard, bony enlargement located on the inside of the fore cannon bone. It may appear occasionally on the outside of the front leg and rarely on the hind legs. During the formation lameness may occur but later this will disappear; however, the enlargement persists. Unless the splint causes lameness it is a blemish.

WINDGALLS OR WINDPUFFS. These occur on the fetlocks, and are soft enlargements due to excessive secretion of synovial fluid and are commonly caused by heavy work on hard roads. If lameness results they are an unsoundness, but if the action is not affected they are regarded as a blemish.

BUCKED KNEES. This is a condition where the knees are carried too far forward and it is a weakened conformation.

CAPPED ELBOW OR SHOE-BOIL. Bruising at the point of the elbow by the heel of the shoe when lying down will cause an enlarged or capped elbow.

The hock joint is subject to many deviations from normal condition. Among such defects are spavins, curbs, and thoroughpin. The joint is subject to severe strains and twists. Therefore, it frequently becomes defective. Some of the hock defects do not affect the outward appearance.

BONE SPAVIN. This is a bony growth on the inside forward lower part of the hock. It is often called a "jack." It interferes with the action by interference with normal motion of the joint and is a serious unsoundness. Poorly shaped hocks improperly set are disposed to bone spavins. Sprains, over-exertion, or hard work may be the exciting cause.

BOG SPAVIN. Normal hocks are clean cut. When there is a noticeable filling or seeming swelling at the hock it is called a bog spavin. It is caused by an enlargement of the synovial sac surrounding the joint and an excess secretion of synovial fluid. This does not always cause lameness, but it detracts from the appearance and also the outcome may be questionable.

BLOOD SPAVIN. This is somewhat akin to the bog spavin although this refers specifically to a varicose vein, usually below

the seat of a bog spavin. It is in the front and inside part of the hock. Since it appears not to affect normal action it is a blemish rather than an unsoundness.

CURB. A curb is enlargement of the bone on the back of the hock about five or six inches below the point. Such enlargements on the back face of the hock are due to faulty conformation as sickled hocks and severe strains.

THOROUGHPIN. A soft swelling which appears in back and on the upper part of the hock and in front of the large tendon is called a thoroughpin. It may be pressed from one side to the other, consequently the name.

CAPPED HOCKS. Bruising of the point of the hock will cause an unsightly swelling or cupping which does not materially affect the serviceability of the horse.

STOCKED OR SWOLLEN LEGS. It is not unusual to have the legs swell or stock up, especially during periods of inactivity. Not infrequently it appears in mares heavy with foal. It detracts from the appearance and must be regarded with suspicion.

STRING-HALT. This is a nervous disorder in that there is a sudden flexion of the hock and the foot is moved higher than



Ringbone



Bone spavin or "jack"



Bog spavin

FIG. 290. Common unsoundnesses of horses. (Harry Linn, Iowa State Department of Agriculture.)

normal. There is a wide range in the degree, and it may occur only occasionally.

STIFLED. When the patella is displaced the horse is stifled. If the patella has moved toward the outside of the leg the condition is serious and practically incurable. Occasionally it may slip upward, and under proper conditions it may move back into its normal position.

UNSOUNDNESS OF THE WIND

There are several conditions of the breathing or "wind" that detract from the value of a horse. Common among these are heaves, roaring, and whistling. In the examination or winding the horse is exercised and then the wind inspected. Such working also demonstrates willingness to work and to some extent fitness for work.

HEAVES OR BROKEN WIND. This is a disturbance in breathing in which an extra effort is made to expel the air from the lungs. This special effort or "double lift" is required because some of the air vesicles of the lungs are ruptured. Upon exercising, a wheezing noise is made in breathing and a characteristic short cough is common. The cause may be improper feeding. This is a serious unsoundness.

ROARING AND WHISTLING. This refers to the noise made by a horse when air is inspired into the lungs. Usually such horses are termed "thick in the wind." The exact cause may be one of several conditions which inhibits normal inward passage of air.

UNSOUNDNESS OF THE HEAD

On this part of the body we find the following conditions which alter usefulness. A careful examination should be made of the eyes, as serious imperfections may not be easily seen.

BLINDNESS. The lack of perfect vision incapacitates a horse for some kinds of work. In the judging of horses it is a disqualification. *Moon blindness* is a serious disease of the eyes. The attacks are periodic, and usually blindness results in one or both eyes.

CATARACT. This may appear on the eyes of older horses and is recognized by a cloudy or opaque appearance of the eye.

POLL-EVIL. This is a fistula of the poll which may follow a severe injury to that part. It is usually difficult to cure and its treatment requires the services of a veterinarian.

PARROT MOUTH AND UNDERSHOT JAW. In the examination of the teeth, imperfection in the manner in which the teeth come together should be noted. A parrot mouth has too short a lower jaw, while with the undershot upper jaw the lower jaw will extend out beyond the upper jaw.

UN SOUNDNESSES OF THE BODY

There are some unsoundnesses on the body of the horse which inhibit performance. Notable among these are fistulas, sweeney, hipdown and hernia.

FISTULA. A *fistula* appears at the withers. It is a deep-seated sore resulting from a bruise which is often quite persistent. The treatment is largely surgical and requires the attention of a veterinarian.

SWEENEY. This is an atrophy or shrinking of a muscle, the one commonly encountered in draft horses being sweeney of the shoulder muscles. This is due to poorly fitted collars, a severe strain, or an injury.

HIPDOWN. A fracture of the prominence of the hip and a falling away in that area is known as hipdown. The usual cause is an injury such as striking against a door.

HERNIA. When a loop of the intestine pushes through an opening in the abdominal muscles it is called a hernia. They may be scrotal, inguinal, or umbilical depending upon the location. In selection these conditions are selected against since they may affect the performance of a horse.

VICES

There are some bad traits or vices which horses may have that definitely affect their value. These may result from improper training or handling or from a lack of tractability. Horses that kick, strike, bite, show balkiness, or run away are to be avoided, as they can be dangerous unless properly handled.

Of less consequence in the worth of a horse are a group of annoying habits which horses may develop, such as weaving, cribbing, and halter pulling.

Chapter 43

HORSE FEEDING AND MANAGEMENT

Most of the experimental feeding work with work stock has been done with horses rather than mules. The general principles of feeding are practically the same for both. Under the chapter on mules the differences in feeding and management are discussed.

Economical feeding of work stock is the first step in the reduction of the cost of work stock power. The feed cost is the largest single item of the cost of keeping horses. Under usual conditions it amounts to 70 to 75 per cent of the total. In order to keep down feed costs we must feed adequately but not excessively on feeds which furnish the needed nutrients at a relatively low cost. It is also important in keeping work stock costs low to keep down the other overhead costs and to use the work animals to their maximum capacity. The matter of economical rations for horses and mules is often neglected. It is rather common opinion that less attention is given to feeding horses than any class of livestock. Horses are in service for a long period. Therefore, rations that will adequately nourish for a long time are desired. As horses are comparatively long lived, temporary deficiencies in feed intake are slowly reflected in the animals being fed. Such inadequacies cause harm and are to be avoided for long-time usefulness.

Nutritional Requirements of Horses

The horse has a relatively small, simple stomach, but can use roughages quite well as it has an intestine of large capacity. Roughage feeds are used for the major part of the ration because they supply nutrients at a lower cost than the concentrates. Excessive feeding of roughage, on the other hand, may lower the efficiency of the horse. Ruminants may be fed all the roughage they want without ill effects, but such is not true of the horse,

which has a smaller stomach capacity and different type of digestive tract. The roughage intake in horses can be too high considering the health of the horse and the economy of feeding.

Horses are different from cattle in their maintenance requirements. Because of their more nervous dispositions horses require more feed for maintenance, for an equal amount of weight. Actually, we have less experimental evidence upon which to base rational feeding of horses than other livestock. Horse feeding tests have been few, and the estimates of digestible nutrients available are made with ruminants, not horses.

A 1400-pound horse that is doing no work requires the following listed nutrient materials daily according to the Morrison Feeding Standard.

1400-POUND IDLE HORSE

Dry matter, pounds	16.6-23.0
Digestible protein, pounds	0.8-1.0
Total digestible nutrients, pounds	8.9-11.5
Nutritive ratio	1 to 10-12
Net energy, therms	7.2-9.2

The horse at work requires more nutrients than the idle horse, and as the work is increased the suggested requirements of feeding standards are accordingly greater. This greater requirement needed for increased activity involves mainly an increase in the amount of the nutrients, principally energy, rather than a change in the proportion or ratio of digestible protein to total digestible nutrients. Growing colts and brood mares nursing foals also have a relatively higher requirement of nutrients than idle horses. The actual need of a horse or mule is related to the size, age, fatness, activity or work, and individuality.

The needs for a horse at light work are met when one-third to three-quarters of a pound of grain and $1\frac{1}{4}$ to $1\frac{1}{2}$ pounds of roughage are fed daily for each 100 pounds of live weight. When idle, horses should be fed mainly roughage or on pasture. When the work is increased the concentrates are increased and the roughage decreased. The average horse needs from 2 to 2.5 pounds of total feed for each 100 pounds of live weight daily. In practice, the maintenance of weight, the thrift, and the spirit of the horse indicate the state of nutrition. Horses fed un-

balanced rations or insufficient amounts for the work they are doing will lose weight, become unthrifty and spiritless.

Feeds Used for Horses and Mules

The farm-grown grains form the basis for the concentrates used for horses and mules. Of these grains, oats, corn, and barley are the more commonly used. Of the hays, alfalfa, clover, timothy, soybean, prairie, Johnson grass, and grain hay are the ones generally used. There is more regional difference in roughage fed than grains or concentrates.

The coarser roughages such as straw, corn fodder, and sorghum fodder supply considerable amounts of work stock feed in some areas. Such feeds are carbonaceous, and consequently low in protein; also, they are quite high in crude fiber. Feeds that contain large amounts of crude fiber are quite low in net energy value, or that energy which can be used to perform physical labor. Some supplements such as bran and linseed meal, and in the south, cottonseed meal, are used to balance with the locally available feeds. When the ration is mainly of low-protein feed a high-protein feed supplement is advisable.

Home-grown or locally produced feeds are the most economical to use in rations. No single feed combination is the best, and several have been found to give satisfactory results. What to use in the ration then depends upon what is available and economical.

Divisions of the Feeding Problems

It is convenient to divide the feeding problems of horses into the following. 1. Feeding for work. 2. Feeding idle work stock and preparing for spring work. 3. Feeding the brood mare. 4. Colt production. 5. Feeding light horses. Each will be discussed separately in the paragraphs which follow.

FEEDING FOR WORK

It has been previously pointed out that the needs of a draft horse are proportional to the work done. It is apparent that the greatest increase is for the energy-yielding nutrients as physical work is increased. Since very few feeds contain only energy-yielding nutrients, the ration for the work horse is

stepped up in total amount of feed and the feed grains substituted for roughage as the work increases.

That an increase in nutritive material is needed with activity and draft has been demonstrated experimentally. It was found that horses moving at a rate of 2.2 miles per hour used 77 to 144 per cent more energy than when they were not moving. Likewise it was found that 1.87 therms of energy were expended for each horse power of draft performed in addition to the maintenance requirement.

Draft horses are more efficient in the performance of work when they travel at a speed of from 2 to 2.5 miles per hour. When moving at a faster rate than a walk, energy expenditure is stepped up because of greater muscular activity. The walk is done with a minimum of movement and near normal heart beat, respiration, and body temperature.

Work stock feeding often is not varied with the amount of work being done. This is not only uneconomical but distinctly harmful. Regularity is an essential in feeding, but the amounts of feeds, especially the concentrates, are to be reduced by at least one-half when the horses are idle. The use of pasture in connection with irregularity of work or even when the work is regular is advantageous since it supplies many of the essentials often scarce in usual feeds. Pasturing also permits exercising and healthful surroundings, as well as reducing the labor for the care.

FEEDING IDLE WORK STOCK AND PREPARING FOR SPRING WORK

Horse labor on the farm is peaked in the spring of the year while the crop is being put in. Feeding and management of the work stock on the farm is therefore directed toward having them in the peak of physical condition for the spring work. The nutritive needs during the wintering period are comparatively low, but high efficiency in work performance and long-time usefulness cannot be expected if the winter ration is not ample. The winter ration must be sufficient in amount and quality for best results, yet to keep horse labor costs down it must not be excessive or expensive. Cornstock fields and stubble fields with pasture can supply a large part of the nutrients needed,

but should be supplemented with leguminous roughage or other feeds.

The practice of permitting the work stock to exercise and graze on the pastures and fields has been very successful. Access to a straw stack in addition will help in keeping feed cost down.

The housing need can be supplied by open sheds which will afford protection and dry quarters.

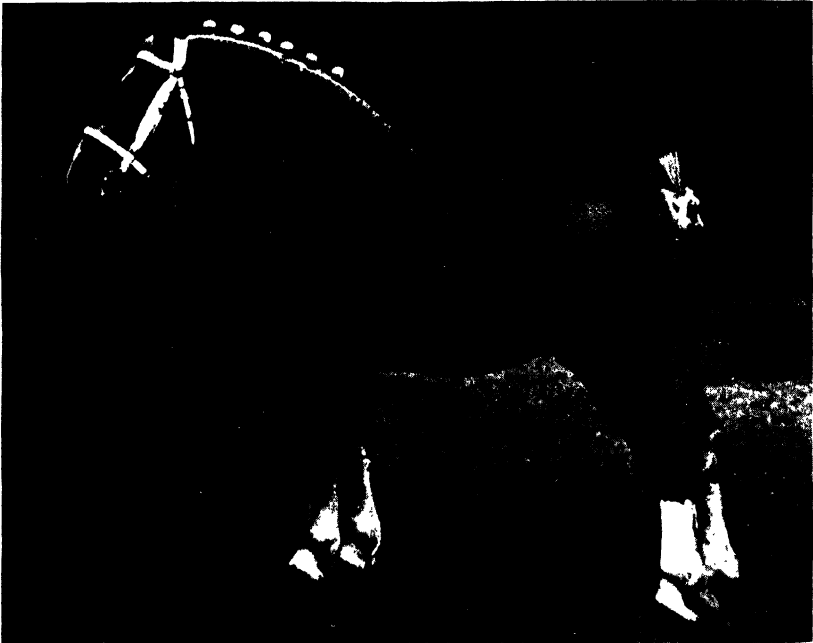


FIG. 291. Feeding capacity is essential for a good draft horse. This two-year-old Belgian stallion has large capacity for feed and has made rapid growth.

At a time two to four weeks before the beginning of spring work conditioning for that work is to be started. The amount of this fitting for work needed is dependent upon how each animal has wintered. In this prework feeding the ration is improved in quality in that the coarse roughages are decreased, quality roughages increased, and concentrate feeding commenced. Changes are to be made slowly on the ration, but the farm work stock should be on a medium work level of feeding when the farm work starts. Medium work requires about one

pound of good roughage to an equal amount of concentrates for each 100 pounds of live weight.

The conditioning for spring work plan and rations may be used for horses being marketed, but it should be started some time in advance of the usual time. The active period of the horse market precedes the spring work. Heavy feeding is needed for fattening, but exercise is not to be neglected as it is highly essential in fitting.

FEEDING THE BROOD MARE

Some special attention is advisable in feeding brood mares for colt raising. The growing of the fetus and the suckling of the foal demand extra nutrients over and above the needs for work or an idle winter season. This may be taken care of by the feeding of more grain and good quality roughage. It is a matter of providing more feed and also feeds adequate to supply sufficient protein minerals and vitamins to mares during pregnancy and suckling.

The method of handling during the idle season need not be different than that for other work stock, but more liberal feeding is essential for best results. By raising some good colts on the farm replacements are available when needed and through the sale of horses the farm income may be increased. At times the cost of production may be higher than the sale costs, that is, when we have an overproduction, but properly timed colt raising can be profitable.

COLT FEEDING

The young colt will at an early age pick at grain, grass, or roughage to supplement the dam's milk. Supplementary feeding may begin when the foal is one to two months old, and such feeding is advisable to get the maximum growth and development. Limited supplemental feeding rather than heavy feeding has been found to be most desirable as a heavy ration may result in damage to the feet and legs. It has been suggested that when horses are high in value and feeds are comparatively cheap rather heavy feeding to hasten maturity may be economical.

Farm feeds are sufficient for colts, and oats top the list as

feed for growing colts. Preparation by rolling appears to be economical.

Colt raising is a profitable adjunct to the maintenance of horse labor on the farm since it involves little cash expenditure and causes but about two weeks' loss of time from work at foaling time with the mare. Colts represent mainly feed, much of which is unmarketable. It has been found that colts are raised to a workable age (about $2\frac{2}{3}$ years) on $2\frac{1}{4}$ tons of grain and $2\frac{1}{2}$ tons of mixed hay in addition to some pasture and field grazing.

LIGHT HORSE FEEDING

In general, the principles of feeding draft and farm horses can be applied to the feeding of light horses. However, smaller quantities of roughage are commonly used for the light horses as a heavy middle will interfere with performance. Economy of feeding is a secondary consideration in light horse feeding; consequently the best quality feeds are used.

Feed Cost for a Horse

The amount of feed needed for a farm horse is dependent upon his size, and on the work done. The pasture and field feed available will affect the amount of other feed needed. With working periods of six months a farm horse will need about $1\frac{1}{2}$ tons of feed grain and $2\frac{1}{2}$ tons of roughage in addition to pasture and field feed. Coarse roughage such as straw or stover can be used as one-half of the roughage, but the remainder should be good quality hay. Four tons of feed then is sufficient for farm work stock which work up to about 120 ten-hour days.¹

Management of Horses

The management as well as the feeding is of importance in the efficiency of the work stock utilization. Management includes all the essentials in the effective utilization of horses and mules for the purpose or purposes desired. A manager must provide ample feed supply, equipment, and man labor and must keep records as well as give attention to many other details.

¹ For a ten-year period Iowa farmers received $50\frac{1}{2}$ cents per bushel for corn, $22\frac{1}{2}$ cents for oats, and \$8.15 per ton for loose hay, which would make a feed cost of \$45.90 exclusive of pasture and field feed.

The care and management is somewhat specialized for such phases of horse husbandry as the brood mare, raising the colts, working horses and mules, and light horses of different kinds. For example, when under hard work shoeing may be needed. A shod horse has better footing and is a more efficient worker under certain conditions. Even under conditions other than hard work, foot trimming is needed. Trimming of the feet of colts, young horses, and idle horses is needed for serviceability. Proper training is another essential for efficient horse and mule use. A well-trained, dependable horse is the object of breaking and training. Proper harness fitting and hitching are also needed for satisfactory service.

Chapter 44

HORSE BREEDING

Horse breeding is quite different than breeding of other farm animals in that a longer time is required both for the gestation and rearing to sexual maturity. Since reproduction is slow and the age of first breeding late as compared with other livestock, errors in breeding or breeding stock management may be very costly. Also smaller herds are general, and horse raising is usually a side line to other farming enterprises. Most farms raise but a few colts, and stallions are quite generally made available to others than their owners for service.¹ Specialized horse breeding farms are known as breeding studs.

The Reproductive Process

Mares of draft breeding may mature at a younger age than those of light horse breeding and can be bred when they are two years old. There is a great difference in the age at which fillies come in heat. The nutrition or feeding as well as the early maturing nature of the individual are related to the age of the first appearance of heat periods. If the mares are heavily worked it is advisable to withhold breeding until they are three or four years old.

The average heat period is about seven days in length, but may range from 3 to 30 days. The oestrous cycle is also quite variable in length; however, the period of heat usually starts 16 days after the end of the last heat. Since the heat period is long and the life of the spermatozoa is comparatively short in the female reproductive tract, time of mating is a factor in fertility. Mating two to five days before the end of the heat period is apparently accompanied with a rather high proportion of fertilization. Mares commonly ovulate one to two days before the end of heat.

¹ Horse breeding is practiced most widely in the mountain and west north central areas where colts are reported on about one-fifth of the farms which have horses and mules.

The natural breeding season of the horse is in the spring and summer, as the hours of daylight increase. The breeding season appears often to be shorter nearer the poles, and in the tropics mares show a tendency to have two seasons of breeding, coinciding with the two periods of increased daylight.

The gestation period is about 335.4 days in length and the standard deviation is about ten days. Because of the relatively long gestation period it is difficult to produce a colt from each brood mare every year. Sometime between the fourth and the thirteenth days following foaling a mare will come in heat and can be bred. Multiple births in horses are not common, there being about 1.5 per cent of twins produced. Studies on the relation of exercise to conceptions have indicated that for high percentage of pregnancies the mare should rest quietly for a while after breeding. Slow travel after breeding in returning the mares home was associated with a higher percentage of pregnancies than fast travel.

The foal develops slowly during the first part of pregnancy, and the rate of growth is increased as pregnancy advances. The size of the foal is probably controlled by internal secretions of the dam. For example, a Shetland pony mare artificially inseminated with sperm from a draft breed stallion will have a foal that she can give birth to. A reciprocal cross may be three times larger at birth and one and one-half times heavier at four years of age.

Stallions that are well grown can be used to serve mares when they are two years old. Ten to 15 mares a season is the capacity for a vigorous two year old. Three-year-old stallions are usually limited to 35 to 50 mares, and four year olds to 50 to 75. A mature stallion will serve from 75 to 100 mares in a season if handled properly.

Much of the irregularity about the breeding of horses can be attributed to improper feeding and management. Good rations and other proper care are imperative to maintain a vigorous healthy condition essential for a sure breeding stallion and mare.

Artificial Insemination with Horses

Artificial insemination has been quite successful with horses. It is possible to inseminate from 8 to 12 mares from a single

service, and the sperm can be kept fertile for a fair length of time. Because of the number of mares that can be inseminated from a single service and the storing properties of the semen, artificial insemination should be more useful in horses than swine, but less useful than with cattle and sheep. Its use in horses,



FIG. 292. Percheron stallion, Marceau, grand champion at the 1940 National Percheron Show and International Livestock Exposition. Owned by R. L. Smith, Stanley, Kan.

especially when an artificial vagina is employed, permits the insemination of several mares from a single service, conserving the energy of the stallion or jack. A valuable sire can sire more colts when this practice is used, and some mares infertile to ordinary breeding conceive when artificially inseminated. Also, nervous or irritable mares may be inseminated without danger to the sire.

Horse Breeds¹

Most of our horse breeds are of European origin. However, the American Saddle Horse, the Standardbred, and the Morgan were created in this country, and we now have some other light breeds in the making. The breeds developed here are light horse types rather than draft horses. A draft horse was developed prior to the advent of the railroads and was used particularly for freight hauling. Conestoga wagons and horses were used in freight service from Pittsburgh, Pennsylvania, to Wheeling, West Virginia. The Conestoga horse was developed for this service, but when horse-drawn freight service was outmoded this breed died out. Of the draft breeds, those from the British Isles, the Clydesdale, Shire, and Suffolk, have been less popular in this country than the two breeds from continental Europe, the Percheron and the Belgian. The type produced within these breeds was shaped to meet the demand of the American buyers, which was for a draft horse somewhat different than the European kind.

In the eastern part of this country a roadster type of horse was developed early in the nineteenth century. Such horses were used for road driving and harness racing. From a mixed foundation of English Thoroughbred, Arab, Barb, and Norfolk Trotter, the Standardbred, an American breed creation, came into existence.

A saddle horse breed, the American Saddle Horse, was developed in Kentucky, mainly from a Thoroughbred foundation.

Breeds on Farms

There are specialized horse farms where light horses are raised, but on the usual farm the draft type predominates. The reason is obvious. Horses are used mainly on the farm, and the most numerous and useful horse on the farm is the draft horse. The draft horse suits the farm as a source of work stock replacement for farm work, and draft horses can generally be sold at a profit to the raiser. Saddle horses have a place on the farm, especially where livestock is a major enterprise, and in the range country horses of this type predominate. The

¹ For a complete discussion of horse breeds, refer to the texts listed in the Appendix.

raising of draft horses, on the other hand, fits into the plan of general farming.

The type of horse raised in a section is therefore somewhat dependent upon the principal need. However, the type of soil and topography of the land are also factors. Heavy draft horses predominate in heavy soil areas, while on the lighter soils

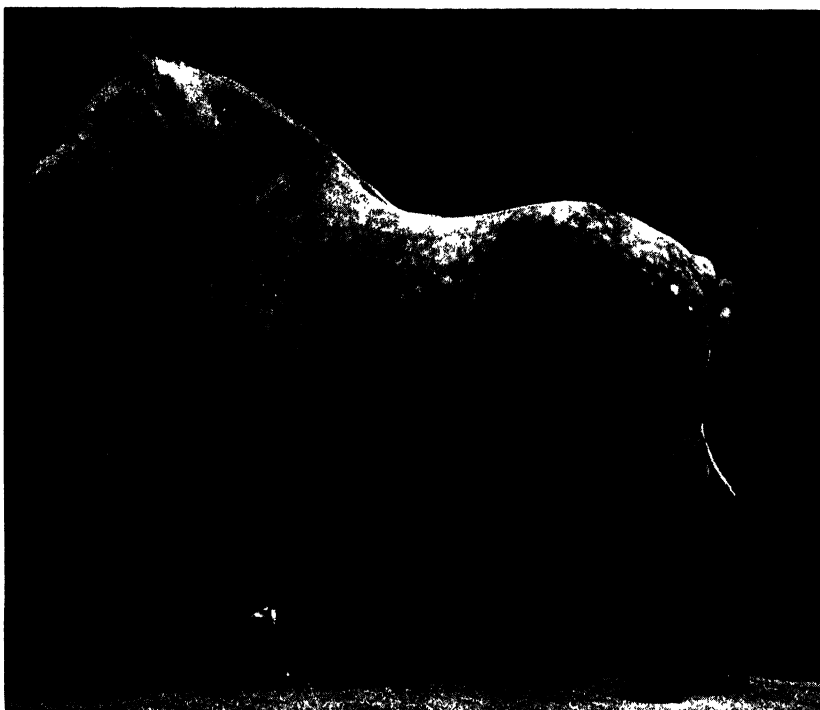


FIG. 293. A grand champion Percheron mare, Nerva, an imported mare. Owned by Fairholme Farms, Lewisville, Ind.

in the more hilly sections lighter horses are preferable for farm work.

Light horse production is more of a specialized enterprise than the raising of draft horses. With light horses, such as saddle horses or race horses, considerable equipment is needed for rearing and training. Based upon the breed of licensed stallions in the 22 states having such laws, the breeds would be ranked in number as follows: Percheron, Belgian, Shire, Clydesdale, Standardbred, American Saddle, and Thoroughbred.

Four draft breeds outrank the light breeds in licensed stallion numbers.

Breed Selection

Within a type the matter of which breed to select is often a problem of concern. The personal choice of the breeder is the



FIG. 294. Belgian stallion, Kenfluer Jay Farceur, a recent International Livestock Exposition grand champion owned by H. C. Horneman, Danville, Ill.

usual solution. In making a choice, the local adaptability of the breed and its availability are worthy of serious consideration. Communities develop a reputation for horses of certain breeds which is an advantage to the individual breeder in breeding stock disposal. Further, stallions are costly and not numerous. Therefore, in an area where one breed is predomi-

nant more sires will be available for use and joint ownership more general.

Breeding Systems

Far less information is available on horses than other farm animals on breeding systems, such as grading up, crossbreeding, and inbreeding. Most of the investigational work with horses has been confined to measuring growth in young and the physiology of reproduction. Strictly genetic studies are comparatively rare. Useful information has come from these researches such as diagnosis of pregnancy, tests of semen for vitality, etc.

The grading-up process, that is, the use of purebred stallions on the mares of common or nondescript breeding to produce *grades*, has been widely practiced.

Crossbreeding has been used in producing horses for a particular use or purpose, such as polo ponies and hunters.

Inbreeding or its milder form, line breeding, has served some horse breeders in building a higher than random relationship to some highly desired individual.

Hybridization has also been practiced in crossing the horse with the ass and the zebra. So important is the hybrid, the mule, that it is discussed separately in Chapter 45.

Breeding Stock Selection

The ideal form or general appearance of the various types of horses has been previously described. In the individual for the breeding herd we want the same ideal conformation plus the sex characteristics, primary and secondary. As in the case with other livestock, selection may be based upon the physical characteristics of an individual, the pedigree, or the performance. The pedigree may be expanded to include the performance of the individual's ancestors. In practice, the choice of a stallion hinges upon a composite of form, performance, and pedigree. Then, too, we have the performance of the offspring, or progeny testing, which when available is a great aid to selection.

In horse breeding we have lacked measures of performance to some extent, although we have had pulling contests for draft

horses, endurance trials for saddle horses, and track records for race horses.

In purchasing a stallion, much care must be exercised since a good stallion represents a relatively large investment. The soundness should be passed upon by a competent veterinarian.



FIG. 295. Belgian mare, Matilda, a recent International Livestock Exposition and National Belgian Show grand champion. Owned by Porath Sons, Northville, Mich.

Unsound horses are not permitted to stand for public service in some states, that is, certain unsoundnesses bar them from public service.

A sire should be free from unsoundnesses of the feet, legs, wind, and eyes. Large size has been demanded in draft stallions for the reason that many of the mares to which they are mated are undersized. Extreme size is not wanted, a draft stallion

weighing 2000 pounds being sufficiently large. Since the demand for city draft horses and horses for logging is now comparatively small and most draft horses are farm horses, great size is not essential. J. H. Edmonds states that the medium size sort are better workers and breeders, they do more work, live longer, and require much less care and attention than the big, overgrown kind.¹

Further, stallions should closely comply with the ideal type. The form, feet and legs, action, quality, and other features are quite similar to those of the draft gelding. The sexual characteristics should show proper development and the potency, if not guaranteed, should be tested. A masculine, well-developed, sound draft stallion, properly reared and handled, should be the goal of the stallion buyer.

Breeding mares to be acceptable should comply with the requirement of their type as previously described. Type, form, size, good feet and legs, and soundness are wanted in brood mares. Also, in their selection the quality, femininity, and reproductive capacity are important.

Numbers Needed for Replacement

As previously pointed out, the average life span of the horse is about 15 years. In this we have a rearing period of 3 years and 12 years of service. The reproductive period in horses is quite long, and also infertility is comparatively high. It has been estimated that only 50 per cent of the mares bred conceive and have foals. The sterility or lack of breeding capacity in horses has been responsible for the breeding investigations directed toward physiology of reproduction.

It has been estimated that with horses it is necessary to retain 35 to 45 per cent of the females and 2 to 4 per cent of the males raised to keep up the population. If a farm is self-sufficient in horses and the service period is 12 years, $1/12$ of the work stock is replaced each year. This rate would provide for the replacement of work stock on the farms where horses are raised, but since the work stock not on farms must come from horse raising farms and all farms on which horses are used do not raise them,

¹ American Society of Animal Production, *Proceedings*, 1940, p. 87.

the productive rate on horse raising farms must be accordingly higher. Of our farms reporting horses and mules in 1940, 9.8 per cent reported horse colts and 1.2 per cent reported



FIG. 296. A Clydesdale stallion, Strathmore Guard, a recent International Livestock Exposition grand champion. Owned by Nelson Wagg, Claremont, Ontario, Canada.

mule colts. The figures included individuals from 3 to 24 months old.

Pedigree

The ancestry is also useful in making a selection for the breeding stud, especially if it informs as to the merit of the individual in the pedigree. Names and numbers in a pedigree are of value only as they convey the merit or demerit of individuals. A pedigree indicates that the individual is purebred, but that in itself may not be helpful as the range in merit of purebreds is considerable. A purebred, however, is generally superior to a grade because of the remoteness of nondescript breeding. Grade

stallions are licensed to stand in some states for public service, and in 1934, of the 13,753 stallions licensed, 9666 were classified as purebreds.

Performance Tests with Horses

There follows a discussion of performance tests that have been used in evaluating horses. Endurance trials have been

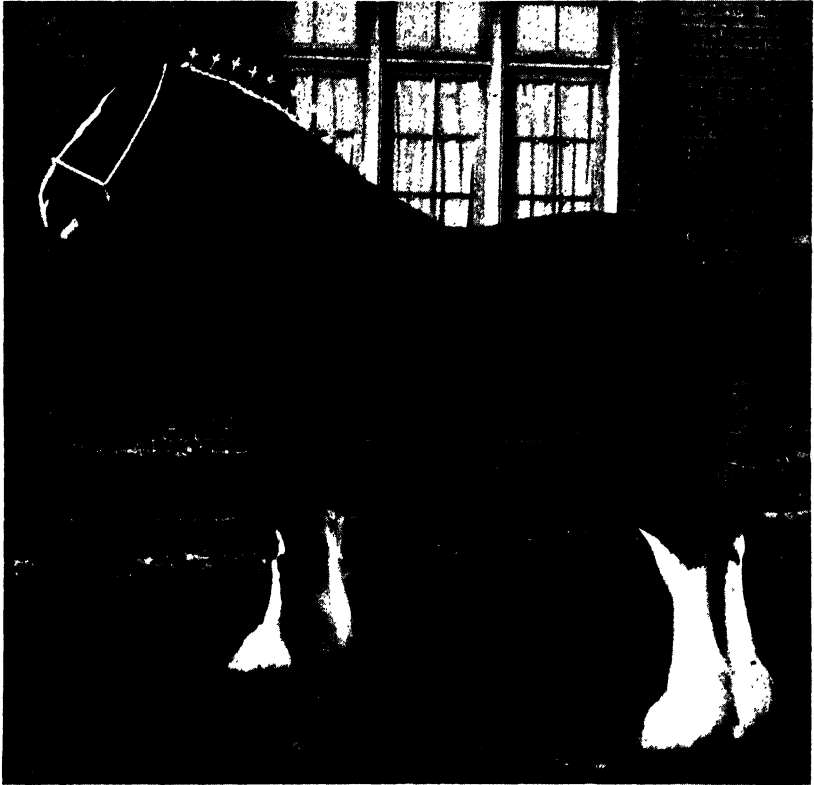


FIG. 297. A Clydesdale mare, Porrs Lona, an International grand champion. Owned by Nils C. Shantz, Plattsville, Ontario, Canada.

used for saddle horses and speed tests or track records for race horses. Neither endurance nor speed can be predicted accurately from appearance. Even measurements of such things as chest length, width, depth, and girth do not give an indication of performance in speed or endurance.

The *endurance trials* or rides are records of performance tests for cavalry horses in which 300 miles are covered under saddle in five days. In the evaluation 60 per cent of the score was allotted to the condition of the horse at the finish and 40 per cent for the speed. The vulnerability of the legs was indicated from such trials as 57 per cent of the entrants experienced leg trouble.

Speed records are used to a large extent by breeders of race horses in mating. The history of the Standardbred in record making is most interesting. Their standard of performance was established in 1879. This placed great emphasis upon performance and the performance of progeny. Although grades and crosses were admitted to registration if they complied with performance requirement up until 1933, most of those registered carried a preponderance of Standardbred breeding in their immediate ancestry. Speed has been increased, which is due only in part to breeding. Faster tracks, better management, better vehicles and harness have also been factors. These improvements, with breeding, have been responsible for the making of more records under 2 minutes in the last 15 years than in the 15 years previous. These records and their use constitute an extensive subject quite beyond the province of this text.

Testing Draft Horses

It is common for draft horses to develop a tractive pull of $1/10$ to $1/8$ of their weight and travel at the rate of 2.5 miles per hour for 20 miles a day. Thus a 1500-pound horse would develop one horse power of tractive pull, since the tractive pull at $1/10$ of the weight would be 150 pounds and the speed would be 220 feet per minute. Speed (220) times tractive pull (150) equals 33,000 foot pounds per minute, or one horse power.

A tractive dynamometer is used to test the draft ability of horses. By means of such tests or pulling contests we have also gathered information on the features of form as correlated with draft ability and also information on training, harnessing, shoeing, and their relationships with pulling ability.

In pulling contests a Collins dynamometer is used to measure the tractive pull. Briefly, the mechanism of the dynamometer permits movement of the vehicle only when the tractive pull equals the weight set on the machine. A distance of $27\frac{1}{2}$ feet

is used in pulling contests to facilitate the calculations. A draft team is given ample time to complete the pull as the contest feature is on the maximum pull. This would not necessarily be the maximum horse power unless it was completed in the minimum of time. For example, one team taking 8 minutes

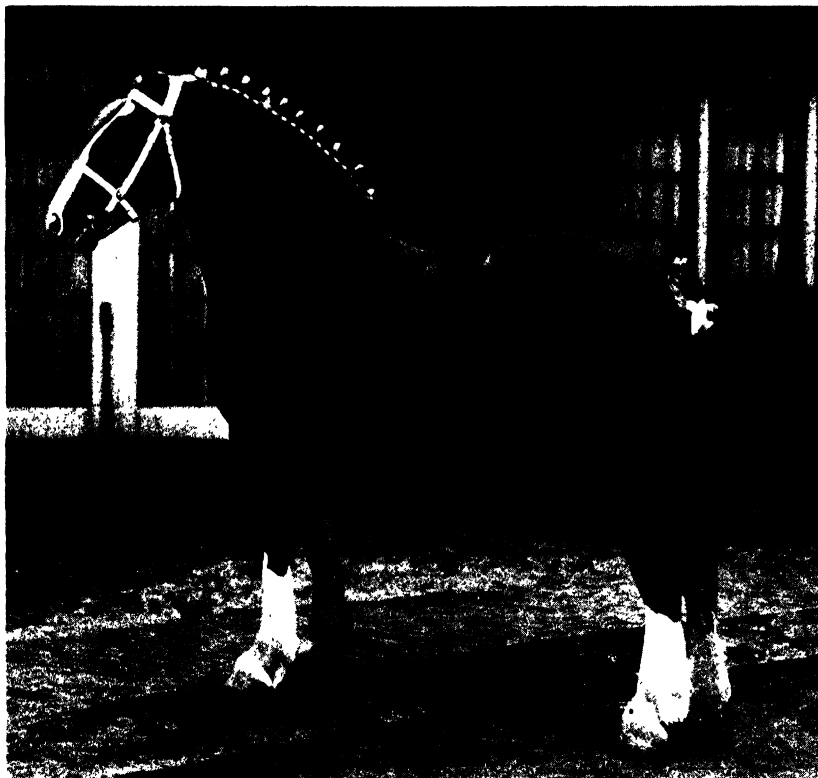


FIG. 298. Shire stallion, Blooms Conqueror, International grand champion. Owned by Schaffenacher Bros., Mt. Pulaski, Ill.

to complete the $27\frac{1}{2}$ -foot pull, say at 3000 pounds tractive pull, would develop less horse power than a team completing the pull in 7 minutes.

Pulling contests for draft pairs were instigated in 1923, and the growth of such competition has been quite remarkable. It is common to divide teams on the basis of weight in such contests. To date, including 1940, the best record made by pairs

under 3000 pounds was made by a pair Jim and Bob, Grade Percherons, owned by Burlist Moyer, Greensfork, Indiana, with a tractive pull of 3275 pounds. (See Figure 252.) With pairs 3000 pounds and up the record is held by Prince, Grade Percheron, and Sam, Grade Belgian, owned by C. B. Kiehl and Son, Bradford, Ohio, with a 4025-pound tractive pull. Both records were made at the Hillsdale County Fair at Hillsdale, Michigan, in September 1940.

The results of pulling contests are summarized each year by the Horse and Mule Association of America. Wayne Dinsmore, secretary of that organization, stated¹ that the results thus far have shown that:

1. Very few pairs can exert a tractive pull in excess of their own weight: out of many thousands of pairs tested, only about 30 have accomplished this. Weight is therefore a limiting factor, almost absolute.

2. Crooked hind legs, commonly termed sickle hocks, are seldom found in good pulling horses. Well-set hind legs are usual in good pulling animals.

3. Great heart girth usually is found in great pulling horses. It probably is true that where horses are equal in weight, but one is greater in heart girth than the other, such animal carries more weight in the fore quarters and has greater room for heart and lungs; but the precise reasons why greater heart girth usually goes with greater pulling power are still unsettled.

4. Careful training is essential. A good horseman trains his animals by gradual increase in load, and avoids getting them stuck. He develops them as carefully and patiently as a skilled trainer of race horses. Physical fitness does not come suddenly. It is the result of good care, feed, and regular work, with wise training.

5. Courage which will not admit defeat is possessed in greater degree by some horses than others. This cannot be determined except by test; but all men who have trained horses by pulling contests know there is a vast difference in the courage possessed by young horses that have not been spoiled in training. Some will try, again and again, on loads they can hardly move;

¹Horse and Mule Association of America, *Leaflet 241*.

others quit after one or two attempts, throw their heads over the other horse in the pair, and try to go in any direction that will avoid the pull. Such animals must be handled carefully and brought along very gradually; even then, they are likely to quit in a contest when the load becomes very heavy. Courageous horses and mules never quit; they will try again and again when asked to do so.

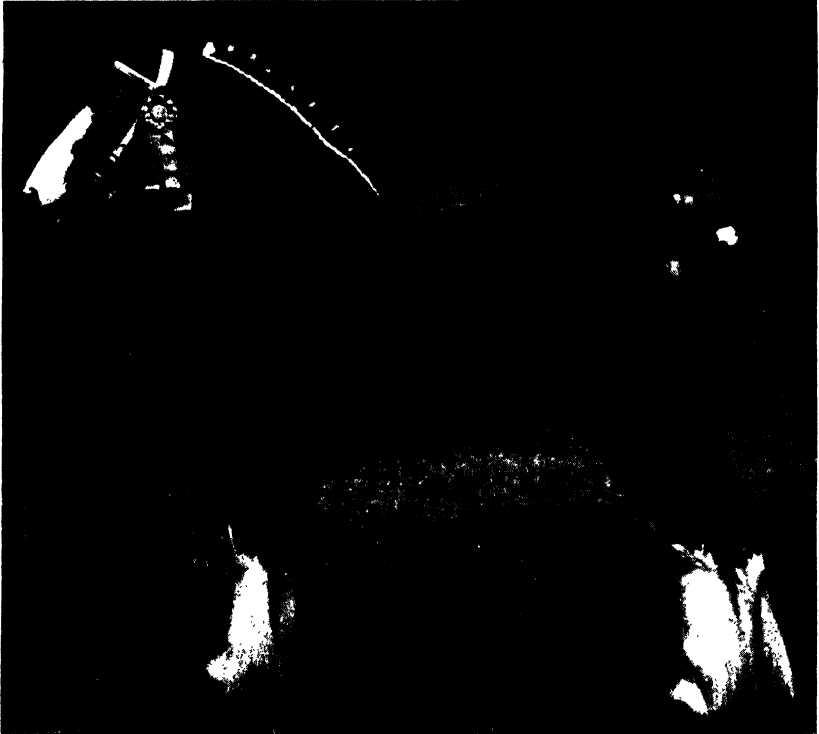


FIG. 299. Shire mare, Josephine, an Iowa State Fair grand champion. Owned by Geo. J. Stoll and Sons, Chestnut, Ill.

It is probably the courage that is inherited: hence sires whose progeny show excellent courage should be sought out and used by men who want especially good pulling teams.

The relationship between success in pulling contests and ability to do work has not been demonstrated. If a definite relationship exists between a short pull and farm work, as appears probable, such tests may be used to evaluate breeding stock. Draft tests of mares and perhaps stallions and their

offspring may be helpful in selecting breeding stock for work stock production. A measure of performance comparable to the speed tests used for Standardbreds, should be useful in constructive draft horse breeding.

Stallion Legislation

The purpose of such legislation is to regulate the stallions and jacks available for public service, preventing the wide use of sires of undesirable heredity. Stallions that comply with certain requirements of pedigree and soundness are licensed, while those regarded as unfit are not permitted to stand for public service. Wisconsin enacted the first law of this kind in 1906, and at present 22 states have somewhat similar laws. These laws are quite variable in their provisions because definite information on the heritability of characteristics is lacking.

The number of stallions and jacks registered under the Minnesota law at about ten-year intervals is probably indicative of the changes in licensing which have taken place in horse breeding areas.

LICENSED STALLIONS AND JACKS IN MINNESOTA

<i>Date</i>	<i>Number</i>
1910	3541
1921	2088
1930	1364
1940	1575

As would be expected, licensing of sires has tended to move up and then down with the volume of horse production.

Futurity Shows for Draft Horses

Draft horse futurity shows are held in connection with many horse shows. A futurity is an early entry in a show or performance to be held at some later date. With draft horses, the entries are made at the time the mare is regarded as being safe in foal. The colts are kept eligible by payment of previously agreed upon fees, and the show is held when the colts are shown as yearlings.

Chapter 45

MULES

Crosses between the two species of the family *Equidae* — the *caballus* or horse and the *asinus* or ass — will produce a hybrid. The term “mule” is reserved for the cross of the male ass or jack on a mare. The reciprocal cross, that is, the stallion upon the female ass or *jennet*, is known as a “hinny.” Since the jennets can be used to produce jacks and jennets, which are generally worth more than mules, few hinnies are produced. Many species, crosses, or hybrids are infertile or partially infertile. The mare mule is seldom fertile, and there are few authentic cases of actual reproduction by female mules. There have been no reported cases of fertility in male mules. Castrating of the horse mule colts is practiced when they are 12 to 18 months of age. Therefore, the males have practically no opportunity to demonstrate their fertility.

Sterility of mules is explained by the difference in the genes of the horse and the ass. The hybrid receives a set of genes from each parent, and these work together properly in the mule, but supposedly will not pair so that the reduction division in maturation prior to fertilization can take place.

Distribution of Mules in the United States

Mules are used extensively in the performance of farm work, but they predominate in the cotton belt and adjoining states. In fact, cotton growing is credited with giving impetus and stability to mule raising. The states having large numbers of mules are listed below.

It should be pointed out that the list is based on the total population of the states and does not indicate the numbers raised. The chief mule-producing states are Texas, Kansas, Oklahoma, Missouri, Indiana, Iowa, Illinois, and Nebraska. The movement of mules in marketing is toward the south, and

NUMBER OF MULES ON FARMS IN LEADING STATES,
JANUARY 1, 1936-1940¹

<i>State</i>	<i>Yearly Average, Thousand Head</i>
Texas	736
Mississippi	357
Georgia	335
Alabama	319
North Carolina	303
Tennessee	291
Arkansas	280
Kentucky	233
Missouri	225
Louisiana	202
Oklahoma	193
South Carolina	186
Illinois	101
Virginia	95
Kansas	81
United States	4477

many of those southern states' mule populations were produced in the corn belt. Jack stock, on the other hand, is produced more heavily in Missouri, Kansas, Texas, Oklahoma, Kentucky, and Tennessee. It seems, therefore, that the breeding of jacks is north of the areas of greatest mule use, and also mule raising has extended farther northward from where jacks are extensively raised. Raisers of horses turned to the raising of mules when more profit could be made with mules. Mares that raised a mule colt rather than a horse colt returned more profit to farmers as the cost of raising is no greater except the service fee, which is usually higher with jacks.

Mules on Farms

In Figure 253 the horses and mules on farms from 1867 to 1940 are shown graphically. The peak year in horse numbers was in 1915, while the peak in mule numbers was ten years later, in 1925. Furthermore, mule numbers have not declined as rapidly as horse numbers. Apparently, mules have not suffered so much from the competition of trucks and tractors as horses. In the cotton belt the replacement of work stock by motor power has been less complete than in many of the other agricultural areas.

¹ *Agricultural Statistics*, U.S.D.A., 1940.

Jacks

The domestic ass or jack stock descended from the African and Asiatic races of the wild ass or the wild form of the *Equidae asinus*. Domestication of the ass is reported prior to the domestication of the horse. References are made in the Bible

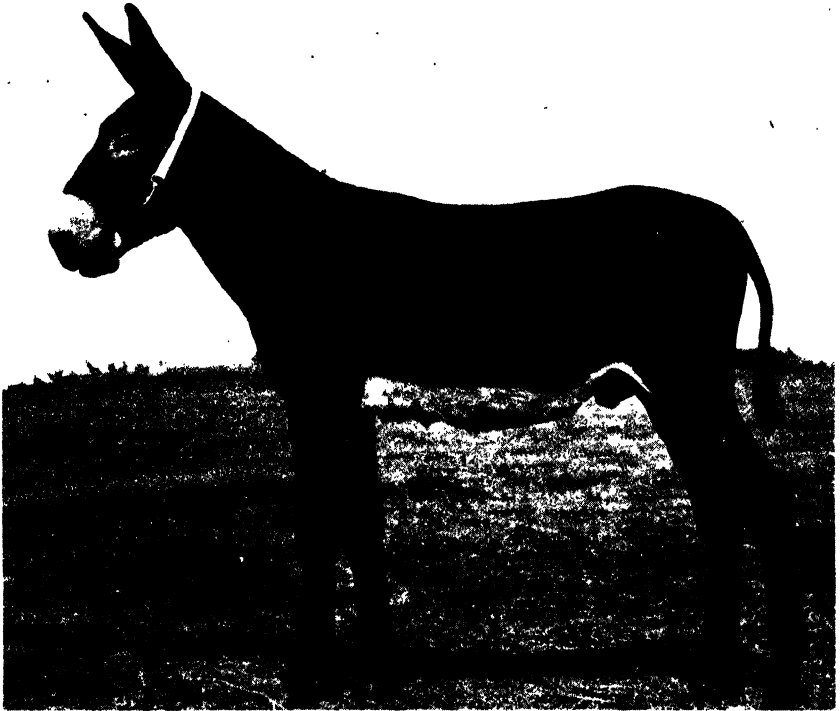


FIG. 300. An outstanding Jack, Bourbon McCord, a grand champion at the Kansas State Fair. Owned by Golden Rule Stock Farm, Ft. Scott, Kan.

to both asses and mules; in fact, the presence of mules six centuries before the Christian era is recorded in history.

Columbus is credited with bringing asses to this continent on his second voyage in 1493. A number of the breeds of jacks have been brought to this country. The breeds included in the importations sent were the Catalonian, Maltese, Poitou, Majorca, Andalusian, and Italian. Most of the stocks came from countries adjoining the Mediterranean Sea. Of these

Ashton¹ gives the greatest credit to the Catalonian breed in the formation of the Mammoth or American Jack. He states that this breed generally represents the type now most in demand by American breeders.

A breed of jacks evolved in the states of Kentucky, Tennessee, and Missouri from these imported stocks was valuable because it produced good mules. The imported stocks were generally not as suitable as the American-developed jack for mule production, as they were too small and not drafty enough. In France, the Poitou breed is used in producing mules that are quite large and comparable to our American mules.

Some of the breeds of asses are quite small and unsuited for raising mules. The stock which came to us from Spain through Mexico is an example. These small "burros" are, with similar breeds of asses, serviceable in warm, mountainous countries for pack, saddle, and draft purposes.

Description of a Mule Jack²

A good mule jack should be not less than 15 hands high and possess plenty of weight, large bone, with quality, style, and action. The most essential points of conformation in a good jack are: a straight strong back, closely coupled and well muscled over the loin; a long, level rump; and a deep body with well-sprung ribs to allow ample room for lung development. Vigor and strength of constitution are indicated by a broad chest and large heart girth.

The legs should be set straight, be well muscled, and have plenty of bone. The length of leg should be in proportion to the depth of the body; height obtained principally by length of leg is undesirable. The size of the bone is very important. It is usually determined by measuring the circumference of the cannon bone about halfway between the knee and the fetlock joint. This should be about 8½ inches in a jack of 15 hands' height. It is also desirable to have large, well-shaped feet and good, sound hocks. The head should be well proportioned, with the profile of the nose straight or slightly Roman. The

¹ John Ashton, "History of Jack Stock and Mules in Missouri," *Monthly Bull.*, Missouri State Board of Agr., Vol. 22, No. 8, August 1924.

² J. O. Williams, "Mule Production," *Farmers' Bull.* 1341, U.S.D.A., August 1923.

ears should be long, well set, and alert on a mature animal and should measure, horizontally, 33 inches or more in length from tip to tip.

MEASUREMENTS OF A GOOD JACK

(Weight, 1300 pounds; height (standard measure), 15 hands, 3 inches)

	<i>Inches</i>		<i>Inches</i>
Ears from tip to tip	34	Around body at girth	70
Around face and jaw	39	Around body at loin	67
Around neck at throat latch	36	Around hoof, below coronet	
Around arm	21	(next to hair)	16½
Around cannon	8½	Above hock	17½
Length from poll to tail	84	Below hock	9½

Some of the common defects in jacks which should be avoided are: flat, narrow chest, which indicates a weak constitution and lack of vigor; light-muscled loin and long coupling; short, drooping rump; excessive length of leg; light bone; poor hocks, with a tendency toward curbiness; small feet with contracted heels; and short or droopy ears.

Most breeders of American Jacks prefer a black color with white points, that is, white around the muzzle, eyes, and along the underline. Gray jacks sire gray mules which turn white when aging; that is objectionable.

An association of breeders of Jacks and Jennets was organized in 1888. For a time certain minimum measurements were required for registration, but now only progeny of recorded parents are eligible for registration.

The jacks that are for jack stock perpetuation are known as "jennet jacks," while those used on mares are called "mule jacks."

Brood Mares for Mule Raising¹

Only sound brood mares of good quality should be selected in producing high-grade mules. Breeders of work horses usually take particular care in choosing good mares for breeding purposes, but ordinarily no consistent effort is made by mule breeders in selecting mares for the production of mules. The idea seems to prevail that a mare which is not suitable for

¹ *Farmers' Bull.* 1341, U.S.D.A., August 1923.

breeding to a stallion is good enough to produce a mule. This is a mistake, for no matter how good the jack may be, it is inconsistent to expect uniformly good mule foals from inferior mares. The same care should be applied in selecting mule mares as is exercised in selecting breed mares to raise horse colts.

The mares used in mule production are generally of no fixed type or breed, and vary from large, heavy draft mares to smaller mares of the light horse type. As the mule is a work animal which cannot directly reproduce its kind, it is not essential that mares used for producing them be of any fixed breeding. It is very necessary, however, that the mares be of the correct size and type. Mules foaled from mares of the draft type are large and heavy and are excellent for draft purposes, but they are more sluggish in temperament and cannot stand the heat as well as mules produced from mares of the light horse breeding. Mules produced from mares of the light horse type, on the other hand, are usually too small to be of greatest value because their dams were not large enough. Experienced breeders state that a very desirable mule mare is one having about one-fourth draft blood and three-fourths light horse blood. A mare of this breeding will weigh between 1100 and 1500 pounds and will produce good-sized mules, with style, action, and stamina.

In conformation, the mule mare should possess all the good qualities desired in the brood mare used for producing good work horses. Some of the most important points of the good mule mare are: a broad chest and large heart girth, indicating a vigorous constitution; a roomy barrel to allow for full development of the fetus; a straight back, strongly muscled over the loins; well-set legs with broad, flat sound bone of good quality; large, well-shaped feet; and feminine character, indicating "breediness." To sum up, the mare should combine size with quality, type, soundness, and breediness. The last term includes a variety of characteristics which make the mare a good mother.

It has been observed by Mississippi farmers that mares should outweigh the mules they are to produce by 100 to 150 pounds.¹

¹ Paul F. Newell and C. J. Goodell, "Work Stock Feeding Management and Production," *Extension Bull.* 95, Mississippi, June 1938.

American Mules

The mules that are raised in the United States from American Jacks excel mules raised anywhere in the world. George Washington in 1785 and 1786 imported both Spanish and Maltese jacks and jennets. Washington extolled the favorable qualities of mules for farm work, and his success with them created much interest in importing jack stock and raising mules.

The mule is a cross which has proved very useful for draft, especially on farms and plantations in the south. The mule is much larger and stronger than his sire the jack and also more tractable. Further, the mule is surefooted, more patient, and more durable than his mother the mare.

Mule colts are the most numerous in the west south central region, followed by the east south central and the east north central, in proportion to the horse and mule numbers in those sections.

Selection of Mules¹

The general form and appearance of the mule should closely resemble that of a horse, and in judging mules the same general points are to be looked for. The nearer the mule approaches the ideal desired in a draft horse the more valuable he is from a market standpoint. In the mule there are certain characteristics derived from his paternal side which are mainly indicated in his bray, disposition, ears, tail, and feet. Aside from these the mule does not differ materially from the dam.

Mules vary in height from the little 12-hand pit mule to the large draft mules standing 17½ hands. The range in height of various classes of mules is given under market classes of mules.

The weight of mules ranges from 600 to 1600 pounds. The average weight of the larger type of mules ranges between 1150 and 1400 pounds and is the range within which the majority of marketable mules are classified.

The form of the mule should be compact, with a deep body, broad chest, full flanks, short back, and well-sprung ribs. Light, waspy flanks, long, narrow bodies, and long backs are not desirable.

¹ *Farmers' Bull.* 1341, U.S.D.A., August 1923.

Quality is rather difficult to define, but is that which every capable judge looks for in any animal. It is indicated in the mule by a fine, trim ear, clean-cut head and joints, flinty, flat bone, well-defined tendons, and soft hair. Quality often marks the difference between a "market topper" and an ordinary mule. A short, thick ear, a coarse head, round, spongy bone, and a hard coat of hair are indications of poor quality against which the judge should discriminate.



FIG. 301. A draft mule of the correct type. Tillie, grand champion mule of the American Royal. Owned by Hineman Jack Farms, Dighton, Kan.

The natural tendency of the mule is to be lazy and obstinate. An active, energetic mule is therefore much desired.

It is in the hind quarters of the mule that the greatest faults of conformation are usually found. The croup is often very short and steep, the hips too sloping, the thighs too narrow, the bone too light, and the hind legs sickle-shaped. These are faults of conformation that judges should discriminate against sharply. It is in the hind quarters and loins that the draft animal obtains propelling power. These portions of the animal,

therefore, should be correctly built and properly developed. The loins should be broad, short, and thickly muscled; the croup long and level; the hips long, level, and muscular; the thighs thick, long, and well muscled; and the hind legs well set, with broad, clean-cut hocks and flat, dense bone. Also, the mule should stand on sound, well-shaped feet.

Although the mule is essentially a draft animal, it is often used for general-utility purposes, especially in the south. Style and action may not be as important qualities in a mule as they are in the light breeds of horses, but when present they add materially to its value. A smart, alert mule, with a long, free stride at the walk and a snappy, balanced trot, is highly desired.

Advantages of Mules

Mules are more resistant to the effect of hot weather, and they are easier to feed since they are less often foundered and have fewer digestive disturbances than horses. The self-feeding method of feeding with corn, other grains such as oats, and hay works quite well with mules as they are more sensible about eating. In the hands of an inexperienced driver a mule may work better than a horse. In fact, under most conditions the mule is far more able to care for himself than the horse. Mules are less nervous and fretful than horses and as a consequence they accept hard work, abuse, and poor handling better than horses. They perform more satisfactorily than horses under adverse conditions. Mules are also less subject to lameness than horses. The hoof of a mule, which has a tough outer wall, is very resistant to wear and stands up well over a period of years with hard work and shoeing. Mules retain good condition even when worked hard and abused; consequently they depreciate less in value than horses. Their stabling needs are less than is commonly needed for horses. Mules are more uniform in color and form than horses; consequently, they can be matched for teams more easily. Heavy work, poor drivers, poor feed, and shelter favor the use of mules. The toughness of mules as work stock accounts for their demand.

As mules will consume feeds which horses will refuse, it may be possible to get work done at less cost than with horses. One investigation indicated that the hourly cost for work done was

least with mules, somewhat higher with geldings, and highest with mares.

As draft animals the mules are not as good as horses. Their records in pulling contests are decidedly poorer than those made by horses on an equal weight basis. This is due in part to the fact that mules crouch less in the pull against the collar and tend to lean forward when in draft. This too causes mules to slip



FIG 302. A pack mule. Weight, 1150 pounds; height, 15 hands. (Horse and Mule Association of America.)

easily on pavement when pulling heavy loads. The smaller feet of the mule are a disadvantage under some conditions, as they have less surface for adhesion. Mules, on the other hand, are more sure footed than horses and better suited to uncertain footing. The small feet make a mule unsuited to soft ground; and they will avoid wet and muddy spots.

Mules are tough mouthed, tricky, and lack the spirit usually shown by horses. Since they are eccentric, slow in response,

and not so dependable in emergencies there is less pleasure in driving them.

Market Classes of Mules

On the large livestock markets mules are classified according to their use and graded in accordance with their general value. As is the case with other kinds of livestock, market classes are variable and there is a disparity in the use of grades. Following is a tabulation of the common market classes of mules. With it is the range in height and weight.

MARKET CLASSES OF MULES AND RANGE IN
HEIGHT AND WEIGHT

<i>Class</i>	<i>Range in Height, Hands</i>	<i>Range in Weight, Pounds</i>
Draft	16 to 17½	1200 to 1600
Farm	15½ to 16	900 to 1250
Sugar	16 to 17	1150 to 1300
Cotton	13½ to 15½	750 to 1100
Mining or pack	12 to 16	600 to 1350
Army mule	These are described on page 701.	

Within the classes market price is dependent upon weight, conformation, quality, temperament, condition, action, and age. Each of the market classes listed above is divided, based upon value or market price, into the grades choice, good, medium, common, and inferior.

The following description of the market classes is adapted from U. S. Department of Agriculture, *Farmers' Bulletin 1341*.

DRAFT MULES

The draft mule class includes the largest mules standing from 16 to 17½ hands high and weighing from 1200 to 1600 pounds. Some exceptional draft mules exceed the maximum weight given for this class. Draft mules are used principally for heavy teaming in large cities, especially in the warmer climates; for contract jobs, such as road grading and railroad work; and for lumber work. Mules used for contract work are generally designated by an appropriate descriptive name, such as "railroaders." The heaviest draft mules usually find their way to the lumber camps. Contract mules must have more quality than lumber mules, but

extreme weight is not so essential. The greatest demand for draft mules is for those between the ages of five and eight years.

There is no special preference in regard to sex, but mare mules are usually higher priced than horse mules. The highest prices paid are for those mules having weight combined with heavy



FIG. 303. A farm mule. Weight, 1350 pounds; height, 16 hands 1 inch.
(Horse and Mule Association of America.)

bone, large, well-shaped feet, strong, short backs, closely coupled, with abundant muscling over the loin and hind quarters.

FARM MULES

Mules purchased on the market for farm work in the middle western states are known as "farm mules." There is more variation in quality and type in this than in any other class, as the demand for a specific type is not so well defined. Mules in this class may be plain draft mules or cotton mules that lack

finish and condition, as the farmer often likes to buy mules with a prospect of developing them into more valuable animals. Many of them are worked for a season and then fitted for the market, where they are placed in one of the other specific classes, such as "drafters," "sugar mules," or "cotton mules."

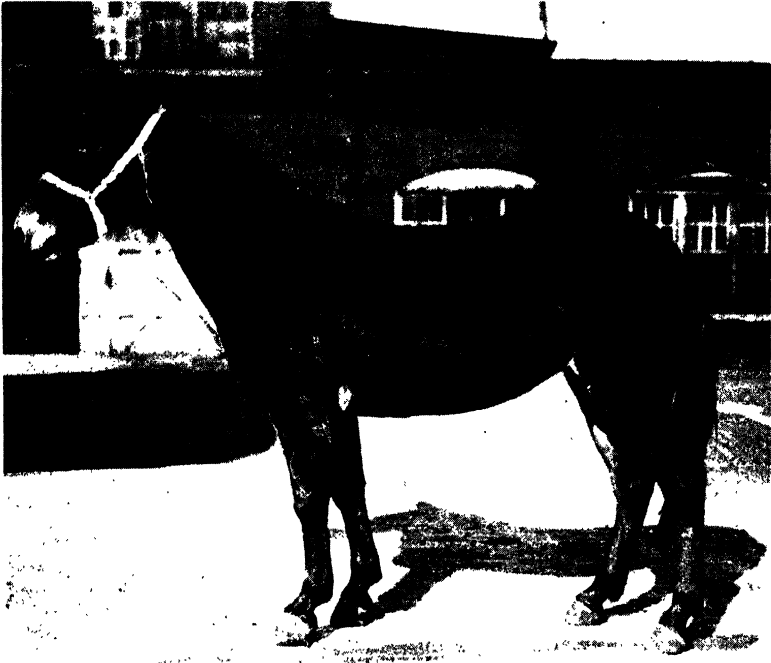


FIG. 304. A large sized cotton mule. Weight, 1200 pounds; height, 15 hands 2½ inches. (Horse and Mule Association of America.)

A survey of farmers by the Horse and Mule Association of America in midwestern states indicated that they preferred mules with a fast walk, alertness, and ability to endure hard work in the heat.

SUGAR MULES

Sugar mules are those which are purchased for shipment to the sugar plantations of the south. This class of mules is somewhat rangy in type and should have good quality, style,

and finish. They are heavier and more compact than cotton mules, but not so heavy as draft mules. The range in weight is from 1150 to 1300 pounds. In selecting sugar mules special attention should be given to quality and adaptability to the work. The feet should be large and well shaped. Mare mules are preferred for the sugar trade.

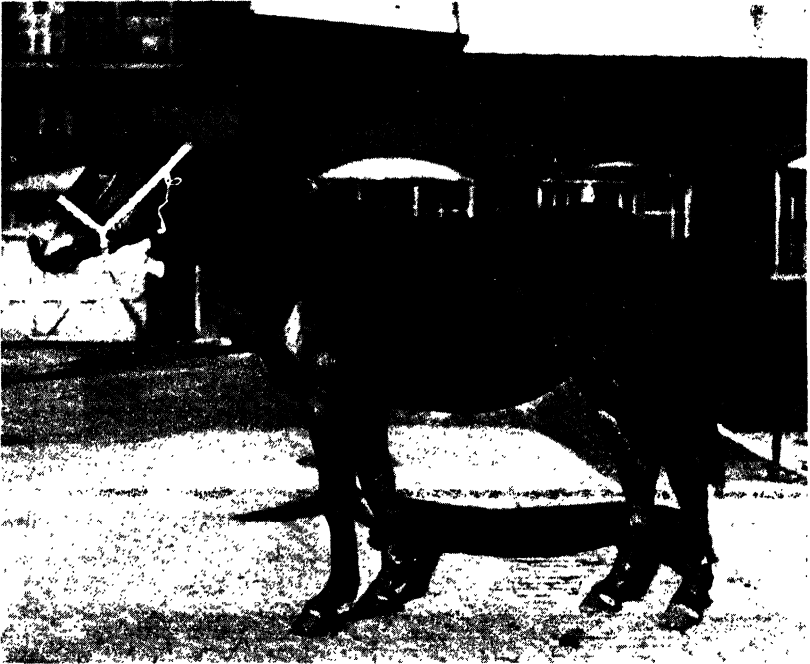


FIG. 305. A medium sized cotton mule. Weight, 1000 pounds; height, 15 hands $1\frac{1}{2}$ inches. (Horse and Mule Association of America.)

COTTON MULES

As the name implies, cotton mules are purchased for work on cotton plantations. The typical cotton mule is somewhat lighter and more angular than the sugar or surface-mining mule but heavier and weightier than the pit mule. While there is a considerable gradation of quality and age in this market class, the planters of the south are more and more inclined to favor increased weight and quality. A choice cotton mule weighs about 1150 pounds and is alert and active, but most mules in

this class range from 750 to 1100 pounds. The age limits are variable. Mules from five to seven years old are preferred, however, and bring the best prices.

MINING MULES

There is a wide range in weight among mining mules, varying from 600-pound pit mules to 1350-pound surface mules. Good feet and freedom from blemishes are requirements for mules that qualify for top prices for the mining trade.

PACK MULES

They are much the same as mining mules in conformation.

To carry heavy loads on their backs they must be thick and blocky, with a strong back and loin, as well as being sure footed.

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